TEACHER'S HANDBOOK

ON

ENVIRONMENTAL STUDIES—SCIENCE

CLASS V

Read. 28/12/89. 28/12/89

INDO-FRG PROJECT: (NCERT-GTZ)

IMPROVED SCIENCE EDUCATION IN PRIMARY AND MIDDLE SCHOOLS IN MADHYA PRADESH AND UTTAR PRADESH

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ON

ENVIRONMENTAL STUDIES-SCIENCE

CLASS V

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NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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FOREWORD

The Teacher's Handbook for class V is a part of the series of instructional materials in ''Environmental Studies-Science'' at the primary stage. It has been developed by NCERT under an Indo-German project titled 'Improved Science Education in Primary and Middle schools in Madhya Pradesh and Uttar Pradesh'. The broad components of the project are the development and production of science kits, development of printed instructional materials and training of teachers. The project is being coordinated and monitored by the Workshop Department, NCERT, New Delhi. It is expected to provide a strong base in bringing about a qualitative improvement in the teaching of science at the primary level in these sates. The project has recently been oriented to provide technical and logistic support to the schemes formulated under the National Policy on Education-1986 (NPE) and Programme of Action (POA). As such the Teacher's Handbook, the Primary Science Kit and the Kit Manual form a significant part of the package listed as essential facilities at the primary stage under 'Operation Blackboard (OB)' scheme. This handbook is the product of commendable teamwork by the members of academic groups of the State Institute of Science Education-Allahabad, Science Kit Workshop-Bhopal, Workshop Department-NCERT, New Delhi, German experts and primary school teachers. Prevailing curriculum framework, guidelines and syllabus on ''Environmental Studies-Science'' were analysed from different angles and then the teaching activities on the content were framed by the academic team. It is hoped that the Teacher's Handbook will supplement the textbook to facilitate the sequential development of the scientific concepts.

I express my thanks to the GTZ, Mr. V. Weisser, educational consultant and German team leader, Mr. H: Proeve, technical expert and other short term experts for providing support and expertise. Thanks are also due to Director, SCERT (UP), Lucknow, Director, SISE, Allahabad, Principal Secretary, CPI, DPI (MP), Bhopal for their cooperation and keen interest. I am grateful to Prof. P.K. Bhattacharyya, Head, Workshop Department and his colleagues for coordinating and implementing different components of the Plan of Operations of the project. I am thankful to Dr. B.K. Sharma who has coordinated and monitored the academic activities of the project, for critically reviewing and editing the final manuscript. I also express my grateful appreciation to all members of the writing team, subject experts, reviewers and participating teachers and the institutions they belong to, for their contributions.

I hope that the primary school teachers will find the handbook useful and interesting. Suggestions and comments for the further improvement of the handbook would be most welcome. The Council will give due considerations to all such suggestions and comments while revising the present edition of the handbook.

P.L. MALHOTRA
Director
National Council of Educational
Research and Training

New Delhi
17 November, 1988

PREFACE

The learner-centred and activity-based approach for exploring the environment has been recommended at the primary stage. Such an approach would provide sufficient opportunities to the learners in the development of desirable attitudes and qualities like self-confidence, rational outlook, curiosity, spirit of inquiry, creativity, objectivity, courage to ask questions, initiative and value appreciation for truth and aesthetic sensibility. This would help in promoting logical and independent thinking, skills of observation, reasoning, analysis, interpretation, problem-solving and decision-making in real life situations for improving everyday living and environmental conditions. In this context, the role of the teacher emerges to be very significant. The teacher should act more as an activity-facilitator, co-investigator and a guide to identifiy the learning resources, instead of acting merely as a communicator and disseminator of scientific informaion. To make best use of the learning situations, there is a pressing need for a Teacher's Handbook (THB) as an instructional material which allows the teacher greater flexibility in the teaching-learning process.

The THB has been developed keeping in view the new roles of the teacher and its use in in-service and pre-service training of primary school teachers and teacher educators. The THB has been divided into four sections. In the first section, some general instructions regarding how to use this handbook have been given.. This is followed by two sections on science-learning approach and use of locally available materials. The fourth section provides detailed instructions to the primary teachers on the description of unit wise learner-centred activities. Most of the activities given in the THB can be easily performed by the students with the help of the items provided in the Primary Science Kit (PSK). Activities based on learner's observations in the environment may be performed using locally available materials. However, some items of the PSK might be needed for that.

The development of the THB has been carried out in several stages. The members of the academic team, comprising of the groups established at the SISE-Allahabad, Science Kit Workshop-Bhopal and Workshop Department-NCERT, first analysed the curriculum framework, guidelines, syllabus and other such materials developed in NCERT and in these States. Thereafter the format containing the learning outcomes, suggested teaching steps and media and materials were developped. The technical team developed the first prototype of the PSK in parallel . Constant interaction between the two teams was maintained. The THB and PSK were finalised only after tryout first in simulated conditions and then in selected primary schools of UP, MP and Delhi. The draft manuscript was also sent to all academicians concerned in the project and also to some organisations and institutions working in this field. The results of try out and feedback thus obtained were discussed, analysed and incorporated in the final version of the THB. The practising teachers representing both urban and rural schools participated in the development and tryout of the THB and the PSK. They had both science and non-science backgrounds.

We acknowledge with thanks the contributions of Mr. H. Hartmann, Mr. Bergmann and Dr. H. Beyer in the planning seminar of the project, Dr. R. Lauterbach and Dr. Schoenherr in the development of instruction and teacher

training materials, Mrs. I. Voss for surveying 252 primary schools in UP and MP and Mr. Schmidt, Dr. Roth and Prof. R.N. Mehrotra for evaluation of the project outputs including the first draft of the THB. The lectures and consultancy reports of Dr. R. Lauterbach of Institute of Science Education (IPN), Kiel, FRG have been very useful to the members of the writing team of this handbook.

We express our sincere thanks to Prof. P.L. Malhotra, Director and Prof. A.K. Jalaluddin, Joint Director, NCERT for their active guidance. We acknowledge with thanks the suggestions of Prof. P.N. Dave, Head, DPSEE, Prof. B. Ganguly, Head, DESM and Prof. A.K. Sharma, Head, DTESE&ES and their colleagues. We are grateful to our colleagues in the Workshop department, the team of authors, editors, advisers, participating teachers and their institutions to make this publication possible. We hope that the teachers and teacher educators associated with primary science education will find this handbook useful. We shall appreciate suggestions from all concerned for further improvement of this handbook.

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New Delhi
11 November, 1988

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(Growth on response to stimuli in living things; Respiration and reproduction in living things; How living things adapt themselves; From seeds to seedlings)

1.1 Do living things differ from non-living things?
1.2 In what ways do plants and animals differ?
1.3 How are plants and animals adapted to their environment?
1.4 Do all seeds of a plant grow into new plants?
1.5 What are the conditions necessary for germination?
1.6 Are sunlight, minerals and water necessary for the proper growth of the plant?
1.7 Do variations exist in the rate of growth of seedlings under similar conditions?

UNIT 2: HUMAN BODY, NUTRITION AND HEALTH 36

(The bone cage—our body and its movement; Deficiency diseases; Communicable diseases; Community sanitation)

2.1 What are the functions of skeletal system?
2.2 What is the relationship between the intake of food with age and occupation?
2.3 What are the deficiency diseases?
2.4 What are the common food practices and beliefs?
2.5 What is the need of preserving food?
2.6 What are the factors for the spread of communicable diseases and measures to prevent them?
2.7 What are the factors that contribute to insanitary conditions in the community and the step to prevent them?

UNIT 3: SOIL EROSION AND ITS CONSERVATION

(Soil conservation)

3.1 What are the different factors that contribute to soil erosion?
3.2 What are the ways to conserve soil?

UNIT 4: AIR AND ITS USEFULNESS

(Air-its uses and its pollution)

4.1 How do we know that air exerts pressure?
4.2 How do we use air in inflating things like balloons and also in moving liquids?
4.3 What are the gases present in the air and in what ways are they important to us?
4.4 How do we distinguish between fresh and polluted air?
4.5 How do we recognise that polluted air is harmful to us and fresh air is essential for good health?

UNIT 5: FORCE, WORK AND ENERGY

(Force, work and energy; Simple machines)

5.1 What are the effects of applying force on different objects?
5.2 What happens when force is applied on soft objects?
5.3 What are the different ways of exerting force?
5.4 How is force exerted by gravity?
5.5 How is force exerted by a magnet?
5.6 How can work be made easier with the help of simple machines?
5.7 What are levers?
5.8 What are pulleys?
5.9 How does an inclined plane help in lifting?
5.10 How is wedge useful to us as a simple machine?
5.11 Is energy required for doing work?
5.12 Are sources of energy limited?
5.13 How is energy conserved?

UNIT 6: THE EARTH AND THE SKY 102

(Shadows)

6.1 Whar are transparent, translucent and opaque objects?
6.2 What are the factors affecting shadow formation?
6.3 How does the length of the shadow formed by the SUN change from morning to evening?
6.4 How do eclipses occur?

UNIT 7: NATURAL RESOURCES OF EARTH 116

7.1 What are the natural resources on the surface of EARTH and underground?
7.2 How do human beings use different natural resources?
7.3 What is the need of conservation of natural resources?
7.4 What are the steps for conservation of natural resources?
7.5 What are renewable and non-renewable resources?

I. HOW TO USE THIS HANDBOOK

This handbook aims to provide you various learner-centred activities on the seven units of Environmental Studies: Science * based on new syllabus for Class V developed by NCERT. These activities are meant to encourage the students to explore the environment through their observations. In order to link the content, the names of the chapters of the text book, related to a unit have also been mentioned along with the unit titles.

The handbook describes the activities most of which can be performed using items of the Primary Science Kit. However, some activities may not require kit items as these are based on the learner's own experiences. Each unit has problem-oriented topics (in an interrogative form) numbered as 1.1, 1.2, etc. Each topic deals with activities numbered as 1.2.1. 1.2.2, 1.2.3, etc. For example, 1.2.3 means unit 1, sub-unit 2, activity 3 and 1.6.E2 means unit 1, sub-unit 6, extension 2. It is very important for you to prepare in advance for performing on-going activities on certain topics for which the suggestions are also given. Time schedule to cover the topic by performing various activities is also suggested. In case you are interested in additional activities, you are at liberty to do so.

In order to guide 'your' activities, learning outcomes and structured teaching steps are suggested to facilitate the sequential development of the concepts. Motivational questions on the activity are also suggested. Wherever required, the answer-clues for some questions are given. Media and materials required to perform the activity are also suggested. These may include the kit items as well as locally available materials. The kit items in the media and materials column have been mentioned in red. In case you can do a particular activity using only locally available materials, you can do so. To assist you in this matter, a separate section III on locally available materials is also included. For proper recording of the observations and drawing inferences, tables have been suggested. For your reference, some of the tables have been partially filled in. You should get these tables completely filled in by the students. Most of the activities are followed by extension activities in the form of project work, field trips, group discussion, collection, sketching, etc. You may add or modify the extension activities according to the local situations and locally available materials.

* See also the textbook 'Exploring Environment', Book III for Class V, NCERT, New Delhi (under preparation)

III. SCIENCE LEARNING APPROACH

There has been a rapid expansion of scientific knowledge in recent years. Realisation of the relevance of science education as reflected in human thought, style, social values and culture have made it imperative to upgrade the curriculum and learning approaches of science in order to improve the quality of life. To make a student (learner) a scientifically literate citizen as envisaged in the National Policy on Education (1986) there is an imperative need for the learner to

- understand and apply the basic concepts of science,
- learn scientific inquiry skills of gathering information,
- develop desirable attitudes and value appreciation for truth and objectivity,
- nurture creative talents,
- learn scientific method and apply it in solving problems and making decisions to improve everyday living and environmental conditions and to promote development and use of technology.

For achieving these objectives, it is necessary to shift emphasis from rote memory-based, content-oriented and teacher-centred method of teaching, to

- problem solving-based,
- activity-oriented,
- performance-based, and
- learner-centred approaches.

These approaches would require learner to

- investigate,
- develop observation skills,
- record observations,
- structure, organise and communicate information,
- hypothesise,
- collect and analyse data,
- draw relevant inferences,
- design solutions and act accordingly.

Activity-based learning makes science more interesting, motivative, effective and meaningful. This provides plenty of opportunity for thinking, reasoning and looking at science in its totality as a highly rational, intellectual problem-solving human activity. This would help in developing qualities like self-confidence, curiosity, initiative, inventiveness, self-reliance, persistence and skills of innovation to solve problems in real life

situations. The sequential development of concepts can then be carried out through these scientific processes and skills. However, to make the best use of the learning situations, it is very essential that the teacher is provided with effective instructional materials in addition to the textbooks. As a teacher you have to plan before hand, outline the general directions and prepare yourself adequately to conduct an investigation. You should read the subject matter from the textbook and this handbook. Then you can make note of scientific ideas, their applications in daily life and the learning processes that may be developed through an investigation. In this handbook, an attempt has been made to provide necessary instructional materials containing a description of learner-centred learning experiences or activities. This also includes points of inquiry and necessary experimental skills for conducting the investigation using items from the kit and also based on learner's own experiences from the environment. Before going to the class, the activities as suggested in the handbook should be tried out. You may also investigate these with some of the locally available resources.

The present science learning approach provides a situation where you, as a teacher, have to work not merely as a communicator of scientific knowledge but also as an activity-facilitator and co-investigator. Thus you will also be a co-learner. You should emphasise on activity-based and 'learning by doing' approaches making use of learner's own experiences and through investigation and problem-solving activities, using environment as a resources. You should stimulate proper learning situation using the materials that are provided in the primary science kit or are locally available. In the learner-centred approach, it is preferable for the students to perform all the activities individually or in small groups. In view of the limited number of the items provided in the primary science kit, sometimes you may have to conduct experiment/demonstration on some topics for the whole class. You should involve the students in understanding various steps of the activity/demonstration. The proper learning situation facilitates personal investigation/small group activity to conduct the investigation for presentation of results and useful discussions. This may also help in carrying out project work by the students. Such an approach would discourage rote learning and promote independent thinking in learners. Careful and skillful observation of sequences and steps during an activity is an interesting experience and is a part of the discovery method. You should ask appropriate questions during the investigation or activities. These questions should help students to become self-confident and independent problem solvers for improving their every day living and environmental conditions, as well as for promoting the use of science and technology.

If an activity does not succeed, do not get discouraged. In such a situation you, along with the students, try to analyse why the activity has not succeeded. A number of ideas may come up for successful performance of the activity. The most reasonable suggestion may then be tried out. If it still does not help, another idea can be tried out till the activity succeeds. By repeating the steps and controlling the procedure during an activity as a method of discovery, the learner is able to understand the whole process more closely, like a budding scientist discovering new ideas or an engineer inventing new solutions to problems or an artist creating new designs.

You should arrange field trips and outdoor projects as out-of-classroom activities and thus give opportunities to students to experience the environment. Seeing, feeling, smelling, hearing and touching are most enjoyable and instructive ways to learn. Assign the students individually

or in small groups to watch the flora and fauna of the environment. You should also ask them to report and exchange their experiences in the class. You should actively participate in lively discussions among the students.

Large drawing on chalkboard is a very effective teaching aid that helps students to learn ideas more effectively. You should also encourage the students to make more extensive use and practice of the chalkboard to explain their ideas, leading to effective learning. You should make use of the charts provided in the kit and ask students to observe these carefully. You should engage the students in purposeful activities like simple chart making, simple inexpensive model making, and collections from magazines and papers which may serve a sensible purpose for further learning.

III. USING LOCALLY AVAILABLE MATERIALS

There are many materials either scrap or available at low cost/no cost which can be used for making equipment for performing activities. A list of such materials along with some examples of the description of the experiments/equipment is given below. However, you can add to this list any other materials which you find suitable.

A. LIST OF MATERIALS OBTAINABLE FROM LOCAL SOURCES

1. Can/canister
2. Plastic container/glass bottle (The bottle can be used for making a tumbler by cutting the bottle with the help of a thread, dipped in kerosene, wrapped round the bottle at appropriate place and then burning the thread)
3. Fused bulbs as magnifying glass, and as container for heating purposes
4. Safety match boxes as container for collecting different materials/weights
5. Teaspoons
6. Rubber bands
7. Rubber balloons
8. Thread/Ribbons
9. Paper/plastic bags
10. Boxes
11. Small mirrors/glass sheets/aluminium foils/cellophane paper/chart papers

12. Flower pots as container
13. Disposable syringes for measurement of liquids and as dropper
14. *Sarkanda* for making different shapes, models
15. Scraps of different kinds of cloth to make dolls, craft work
16. Candles
17. Clay ball as weight/craft material
18. Rubber ball
19. Earthen pot
20. Medicine dropper
21. Thorns for fixing/cutting purpose
22. Nails, screws, wires/wire-mesh
23. Washing soda
24. Sugar
25. Salt
26. Kerosene burner
27. Inks and Dyes/Paints
28. Seeds
29. Leaves
30. Shells/Coconut shell
31. Discarded bird's nest
32. Local rocks, minerals
33. Scrap magnets
34. Empty talcum powder containers
35. Jotter type refill as blow pipe
36. Caps of soft drink bottles as small containers
37. *Agarbatti*

B. MAKING THINGS

B1 Setting up a Terrarium

Purpose: A terrarium is an environment established for small plants and animals living in the soil. This equipment can be set up for the study of terrestrial and amphibian animals.

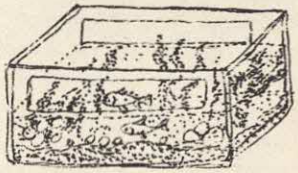
Materials required: An empty oil canister/can, sand, soil, stone pieces, plants, leaf mould, cutter, plastic sheets/polythene bags, wire-mesh

How to set up: Windows of appropriate size are cut on each side of the opposite faces of the canister which is thoroughly cleaned. The top portion can also be removed with the help of a cutter. The other face is left uncut to serve the bottom. The openings may be covered by the removable, transparent, plastic sheets or polythene bags. Small holes are left for allowing the air to pass.

Cover about 2-3 cm of the canister/can with coarse gravel (a mixture of rock pieces and pebbles) for drainage. A handful of charcoal is helpful. Add two parts of soil (garden), two parts of coarse sand and one part of leaf mould. Do not use a rich soil.

Arrange soil high on one side to landscape. Do not pack the soil tight until the plants are in place. Trim plants and shape root balls, dig holes with long stick into the soil and place plants. When planting is completed sprinkle gently with water. Your terrarium is ready. Watch it every few days and note the changes.

For study of frogs, the area can be divided into two parts; dry and wet parts. Cover the openings with wire-mesh, if available, so that animals do not escape.



IV. DESCRIPTION OF ACTIVITIES

In this section, an attempt has been made to provide you with necessary information for learner-centred learning experiences on seven units: Living Things; Human body, Nutrition and Health; Soil Erosion and its Conservation, Air and its Usefulness; Force, Work and Energy; The Earth and the Sky; and Natural Resources of the Earth. These suggestive activities are expected to encourage the learners to explore the environment through their own observations and every day experiences and provide points of inquiry and necessary experimental skills for conducting the activity, using the items from the kit and the environment. Before performing the activities in the actual classroom situation, you should try them out as suggested in this section.

UNIT 1: LIVING THINGS

(Growth on response to stimuli in living things; Respiration and reproduction in living things; How living things adapt themselves; From seeds to seedlings)

Introduction

In classes III and IV, students have learnt about the general characteristics of living and non-living things. They have also learnt that only plants are able to make their own food from simple things like carbon dioxide and water.

In this Unit, the students will be able to

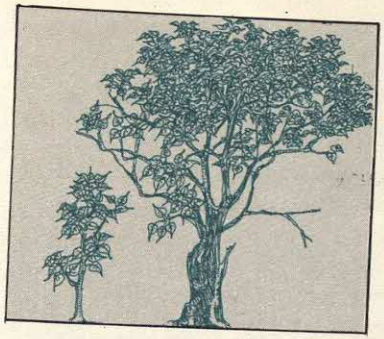
- differentiate between living and non-living things,
- differentiate between animals and plants,
- understand that plants and animals adapt themselves to their environment,
- identify that all seeds of a plant do not necessarily grow with same vigour,
- understand about the conditions for germination and growth.

1.1: Do living things differ from non-living things?

Focus on: Differences between living and non-living things

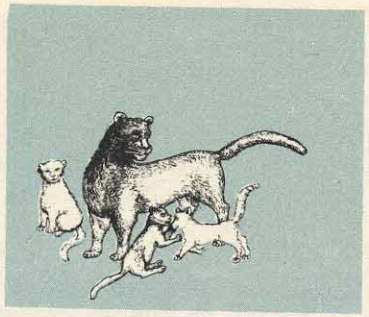
(4-5 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the characteristics which distinguish living things from non-living things	Activity 1 With the help of chart, have a discussion with students. Ask them: What things do you see? In what respects do these things differ from one another?	Chart showing young ones with their adults

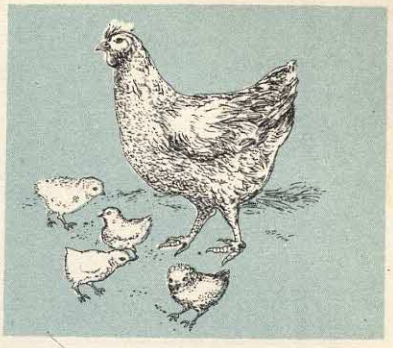


PLANT AND TREE

PUPPIES AND DOG



KITTEN AND CAT

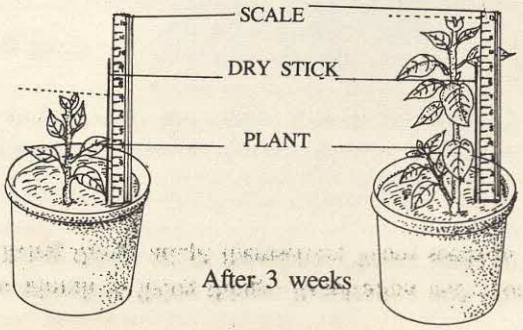


CHICKEN AND HEN

Young ones with their adults

Ask students to take a small potted plant.
Fix a long piece of dry stick by the side of the plant.
Record the height of plant and stick.
Ask them to measure the height of plant and stick after 3 weeks.
Ask them:

A small potted plant, a long piece of dry stick, measuring tape



Growth of a plant

What difference do you find in the height of the plant? (The length of the plant has increased)

What difference do you find in the height of the stick? (No change in the size of the stick; it means it has not grown)

Help them to infer that living things like plants and animals grow, while non-living things (e.g. stick) do not grow.

Identify that living things respire

Activity 2

Ask the students to observe the movement of their chest.

Ask them to close their nose for a few seconds with their hand, keeping their mouth closed.

Ask them:

How do you feel? (Uncomfortable)

For how long can you keep your nose closed?

(For a short time)

Why?

(Not able to breathe)

Which gas is taken in during the breathing? (Oxygen)

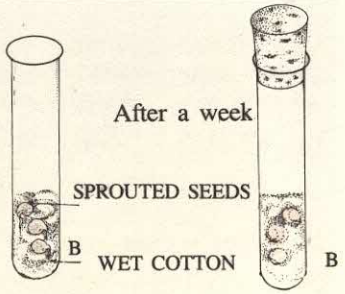
Which gas is given out during breathing? (Carbon dioxide)

Activity 3

Ask students to take sprouted seeds in two separate test tubes containing wet cotton. Label them A and B. Cover the test tube B tightly with a lid/cork/rubber stopper. Let them observe the test tubes after a week.

Two test tubes, lid/cork/rubber stopper, cotton, sprouted seeds, water

Sprouted seeds look healthy



Sprouted seeds get damaged

Ask them:
What is the condition of the sprouted seeds in test tube A? (Look healthy and fresh)
What is the condition of sprouted seeds in test tube B?
(Got damaged)
Why are the sprouted seeds in test tube A healthy and fresh? (They get air to respire)
Why did sprouted seeds in test tube B get spoiled? (They did not get air to respire)
(The carbon dioxide given out by sprouted seeds, gets dissolved in water and form carbonic acid which spoils the sprouted seeds)

Activity 4

Ask students to repeat the previous activity 1.1.3 by replacing the sprouted seeds with pebbles. Discuss:
Do you find any changes in the pebbles?
(No, there is no change)
Help them to infer that living things, such as plants and animals, respire and non-living things do not respire.

Activity 5

Identify that living things respond to stimuli

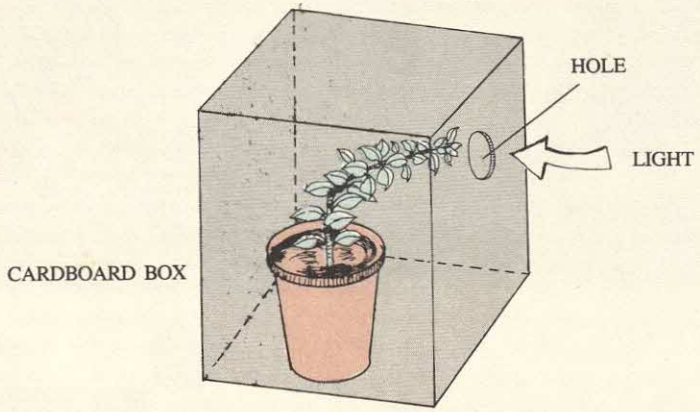
Let the student gently pinch their own arm.
Ask them:
What do you feel?
When you step on a pointed object or touch a hot object why do you suddenly remove your foot or hand respectively?
Ask students to touch the leaves of *Lajwanti* (touch-me-not plant), if available.
Ask them:
What do you observe?

Marble pieces/pebbles

Activity 6

Cardboard box, potted plant

Place a potted plant in a cardboard box with a lid and make a hole on its one side. Ask the students to observe it for 7-10 days.
Ask them:
In which direction has the plant grown?
Why has the plant turned towards the light source?
Help them to infer that all living things (plants and animals) respond to outer stimuli such as light etc.



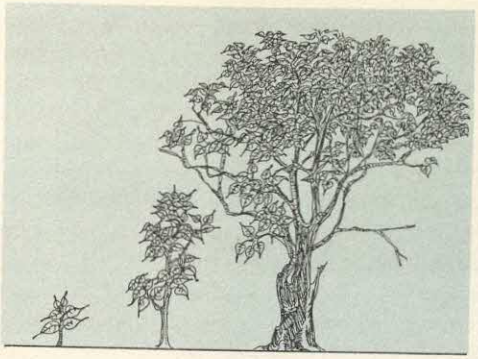
Movement of the plant towards light

Activity 7

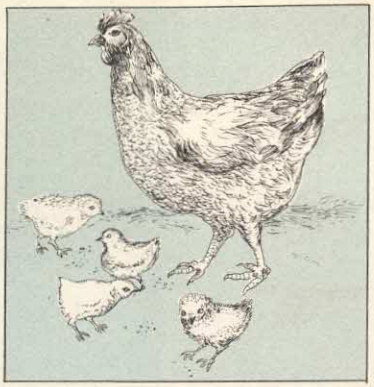
Realise the fact that living things reproduce

Chart of youngones with their adults

Display a chart showing young ones of animals and plants growing into their adults.
Ask them:
What do you see?
Can you produce new rubber/pencil from the rubber/pencil which you have?
Help the students to infer that only living things can produce their own kind whereas non-living things cannot.

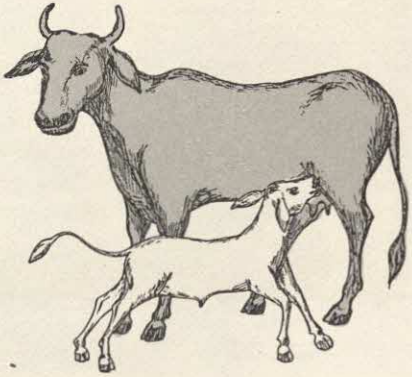


PLANT AND TREE



CHICKEN AND HEN

KITTEN AND CAT



CALF AND COW

Young ones with their adults

1.2: In what ways do plants and animals differ?

Focus on: Differences between plants and animals

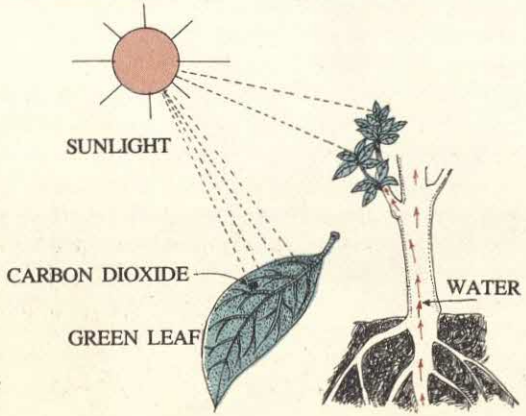
(4-5 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify the characteristics which distinguish plants from animals

Activity 1

Recall the previous knowledge of the students.
Ask them:
Name the parts which help the plants in preparing their food.
Why are the leaves green?
(Due to presence of green pigment—chlorophyll)
Which materials are required by the plant for making food?
(Water and carbon dioxide, in the presence of green pigment and sunlight)
Help the students to infer that plants prepare their own food by using water and carbon dioxide in the presence of green pigment and sunlight.



Green leaves prepare food for the plant in sunlight

If any one of these factors is absent then plants cannot prepare their food.
From where do we get our food? (Plants or animals)
From which animals do you get milk?
(Goat, cow and buffalo)
From which animals do you get meat, and eggs?
(Goat, sheep; hen)

GOAT

SHEEP

HEN

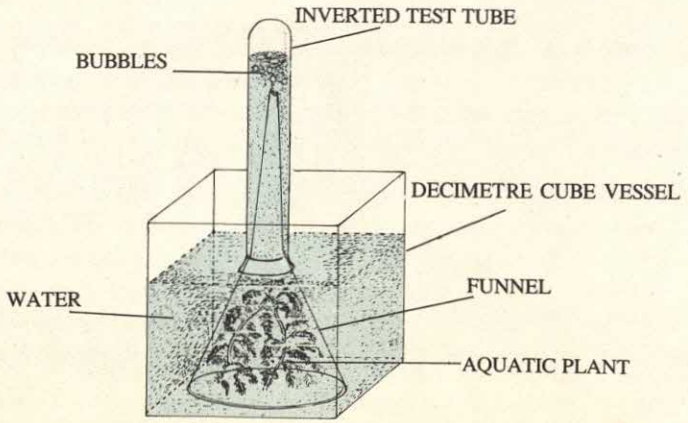
From where do animals like cow, buffalo and goat, get their food? (From plants)
What do animals like tiger, lion, wolf, eat?
(Flesh of deer, sheep and other animals)

Help them to infer that human beings and animals depend directly or indirectly on plants for their food; and this is the major difference between plants and animals. Plants have a peculiar green pigment (chlorophyll) which helps them to prepare food from the materials like water and carbon dioxide in the presence of sunlight. In preparation of food, green plants give out or liberate oxygen.

Activity 2

Ask the students to take the decimetre cube vessel filled three-fourth with water. Take an aquatic plant (the plant which grows inside the water, like Hydrilla, Ceratophyllum, etc.). Put this plant under the inverted funnel into the vessel containing water as shown in figure. Now take the test tube filled with water. Keep the thumb on the mouth of the test tube and keep it over the stem of the funnel according to the figure. Now keep the whole apparatus in sunlight and observe it after an hour.

Decimetre cube vessel, funnel, test tube, water, aquatic plant (Hydrilla or any sub-merged plant)



Liberation of oxygen as bubbles during the preparation of food by green leaves of the plant

(For better results, sodium bicarbonate may be added to water)
Ask them:
From where are these air bubbles coming out?
(From the green plant)
Now ask students to replace this aquatic green plant by taking a root/non-green part of the plant and again observe it after 1-2 hours.
Ask them:
What do you observe?
(No air bubbles coming out)
Help the students to infer from their observations that the pigment (chlorophyll) is needed along with water, carbon dioxide and sunlight to prepare their food. It is because of this reason that animals and human beings depend on plants for their food. Plants are the primary producer of food for all living things.
Note: Euglena is an animal but has green pigment (chlorophyll). So it can make its own food.
Ask them:
Identify the characteristics which distinguish animals from the plants.
Name some plants which they see in their surroundings.
Which of them move from one place to another?
Explain to them that most plants do not move from one place to another while animals can move from one place to another. Some sea animals like sea feather, seapen, corals, are static and are not mobile (non-movable). Most of the plants do not move from one place to another but some aquatic plants like chlamydomonas, volvox, etc. are movable.
Ask them to list differences between plants and animals.

E 1

Ask students to collect pictures of five animals and five plants from their surroundings and paste them in their scrap-book.

Scrap book, pictures of five animals and plants, gum

E 2

Ask students to fill up the table.

Living thing	Plant	Animal	Can move	Cannot move	Source of food	
					Plant	Animal
Goat	X	✓	✓	X	✓	X
Rose						
Parrot						
Tulsi						
Butterfly						
Lotus						

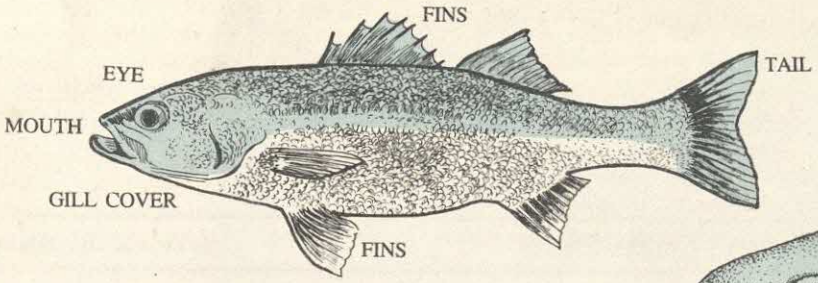
1.3: How are plants and animals adapted to their environment?

Focus on: The structure of plants and animals in relation to their environment

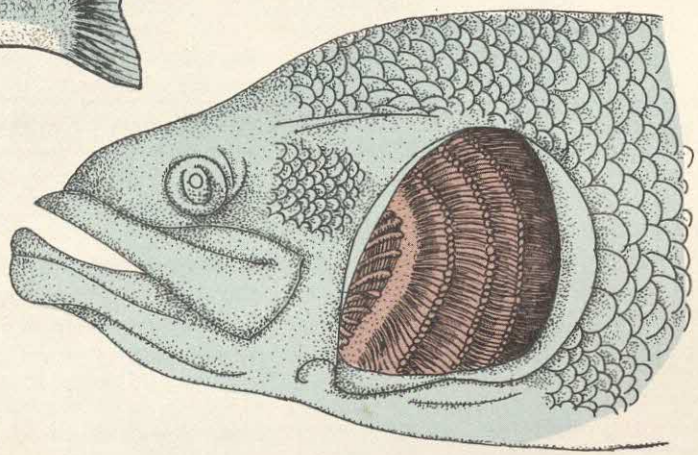
(6-7 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the special characteristics of plants and animals living in water	Activity 1 Show the chart/specimen of a fish. Ask them: Where does it live? Ask the students to name some animals which live in water. How does a fish move? How does a fish breathe? (Through gills under the gill cover) What is the shape of the body of a fish? (Streamlined; this shape is pointed at both ends and broad in the middle)	Chart showing the gills of a fish, a live fish, or a chart showing external features of the fish

Help them to infer that structures like gills, fins and a streamlined body enable the fish to live in water.



External features of a fish



After removing the gill cover

Activity 2

Show the chart of a frog hopping on land/swimming in water. Ask one or two students to hop like a frog.

Ask them:

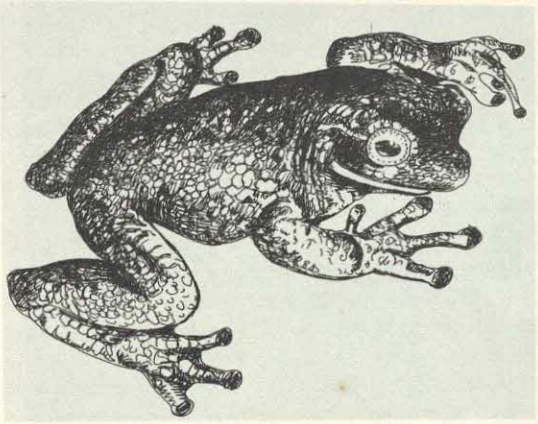
What structures help a frog to live in water?

(Webbed feet and mucilaginous skin)

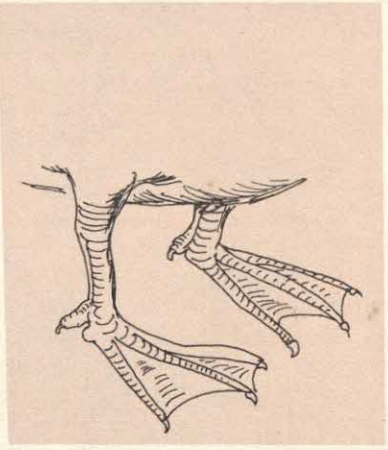
How do frogs breathe in water? (Through skin)

Chart showing external features of a toad and a jumping frog

Which part of their body helps them to swim?
(Webbed feet)
Which part of their body help them in hopping on land?
(Hind limbs)



Toad



Webbed feet of a duck

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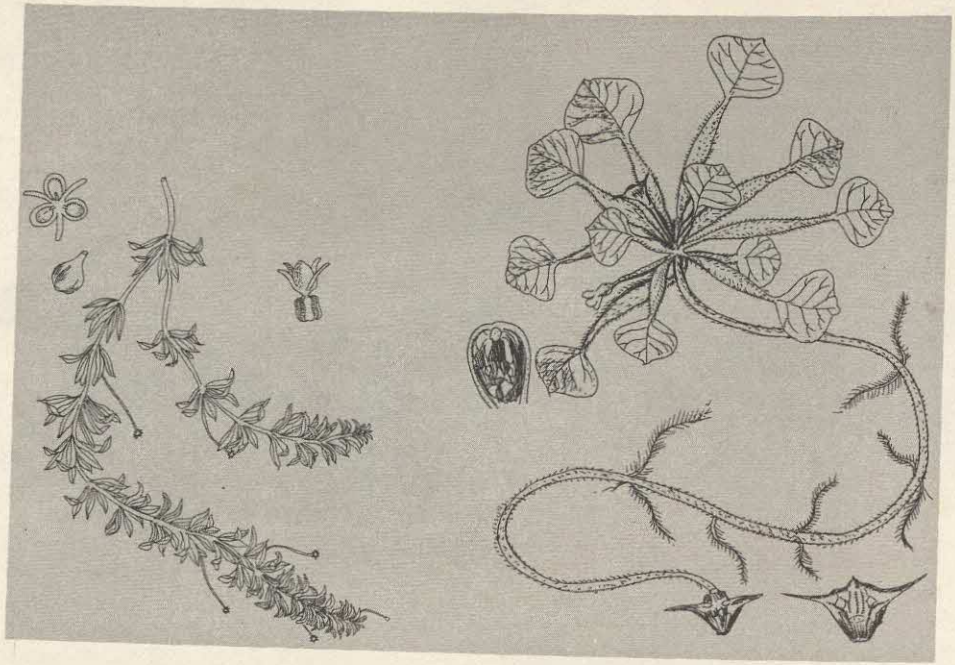
How does a duck swim in water? (Using the webbed feet)
What happens when you try to catch a frog?
Why does it slip away?

Help the students to infer that long hind limbs, webbed feet and slimy, moist skin help the frog to adapt itself to live in water as well as on land.

Activity 3

Ask the students:
Where does the lotus grow?
Show the chart of some aquatic plants (floating and submerged) and a terrestrial plant, along with the transverse sections of their root, stem and petioles.

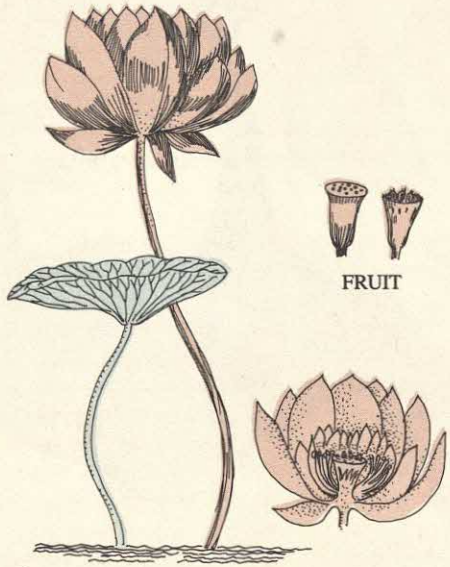
Chart of some aquatic plants like hydrilla, trapa



Hydrilla Trapa

Ask them:
What difference do you find in the transverse section of the stem of an aquatic plant and a terrestrial plant?
What difference do you find in the petioles of a water plant and a terrestrial plant?

Chart of lotus plant and its fruit



Lotus plant

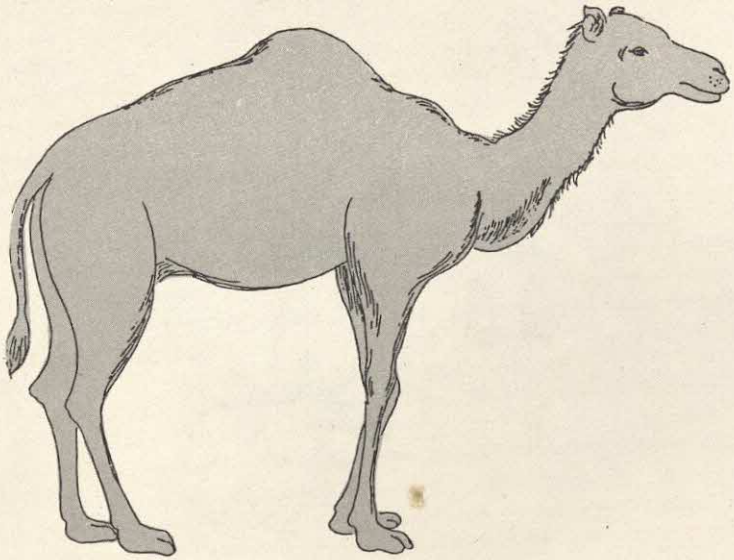
Help students to infer that like a sponge, the leaves, stems and roots of an aquatic plant have air spaces which help them to float on water.
What helps the lotus fruits to float on water?
(Large number of air spaces present in the fruit)

Identify the special characteristics of animals and plants living in deserts

Activity 4

Show charts of some desert animals like the camel.
Ask them:
Name animals which live in deserts?
What type of feet do you see in a camel?
(Large padded feet)

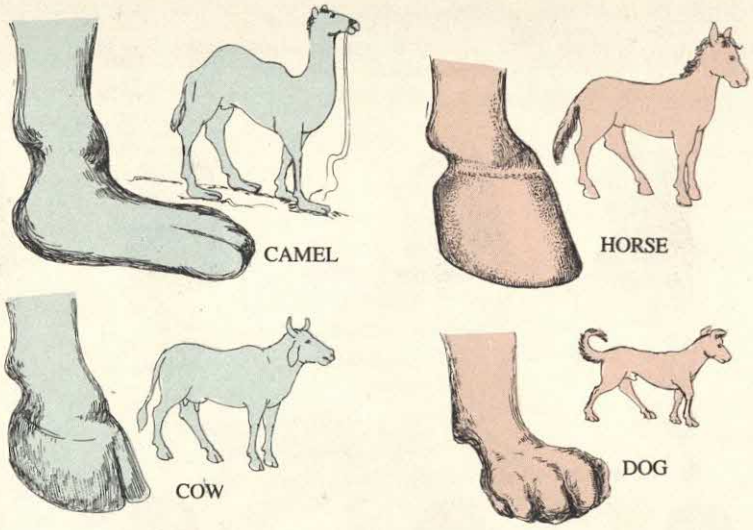
Chart of a camel



Camel

How do they differ from the feet of a horse, cow or a dog?
Can animals like horse, cow and dog, run easily in the desert?

Chart showing feet of camel, cow, horse and dog



Feet of different animals

Why can camel run easily on the sand?
Why is camel known as the ship of the desert?
(Camel is the chief mode of travelling and transporting in deserts)
How does camel live without water for many days? (Camel has a water bag in tbe body)
Help them to infer that these features help the camel to live in deserts.

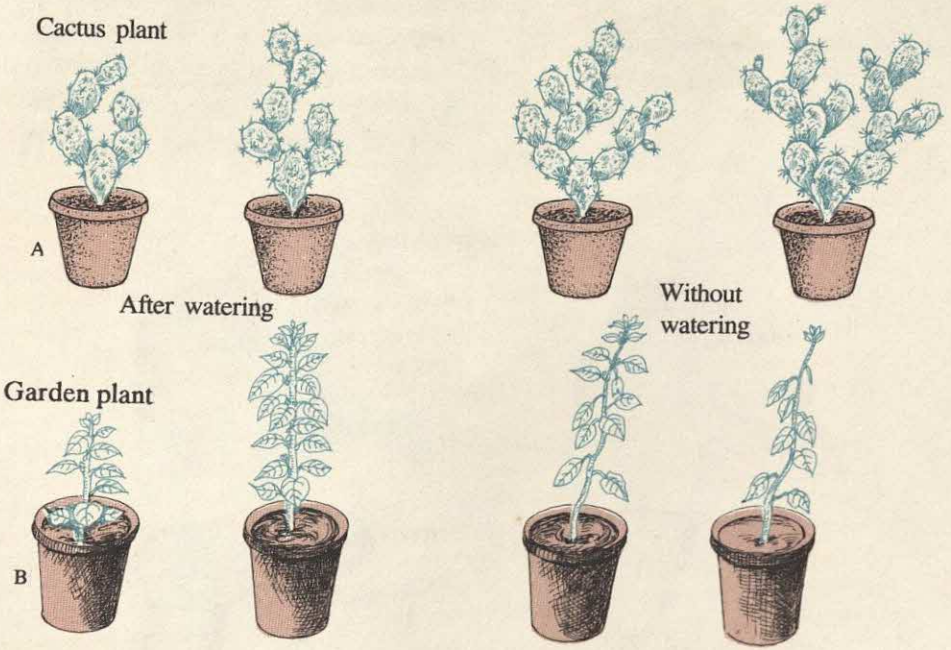
Activity 5

Ask students to take two potted plant, a cactus plant and a garden plant, marked A and B respectively.

Keep both of them in the sun-shine without watering. Ask them to observe for 2 weeks.

Two potted plants (cactus plant; any other common plant like balsam, *sadabahar*, or coleus)

Ask:
Which plant has dried up?
Why has the plant A (cactus) not dried up?



Help them to infer that plants which grow in deserts have special features like green flattened and fleshy stem and leaves which may be reduced in the form of thorns to check transpiration ie. loss of water. Flattened stems are for preparing food and storing water.

Explain that xerophytic plants, like cactus, develop special features to check the loss of water, while other plants do not. These special features help the plants to adapt under desert conditions.

Identify the special characteristics of animals and plants found on mountains

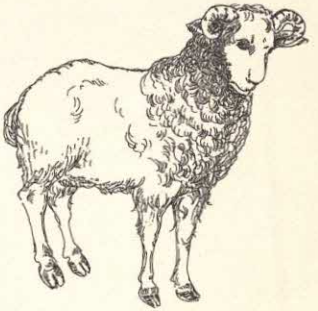
Activity 6

Show the charts of some animals and plants, living in the cold climate of mountains. Ask them:

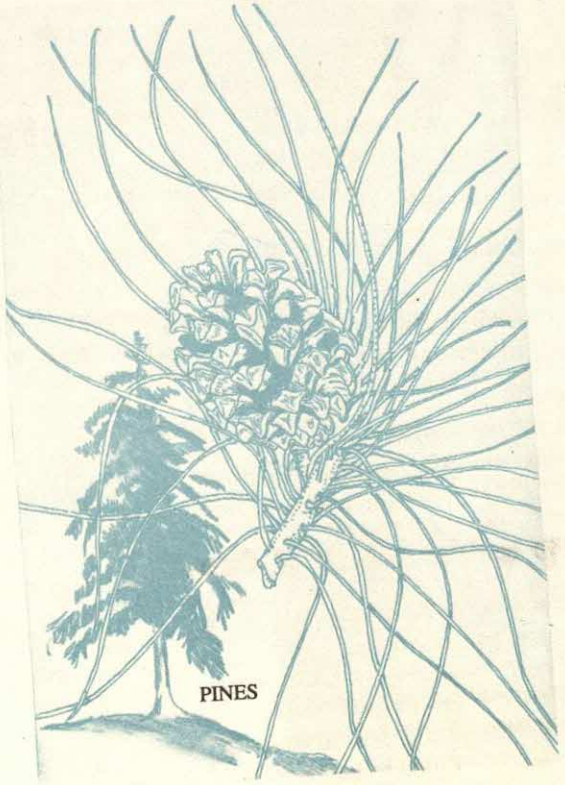
Which body features help these animals to protect themselves from the cold? (Thick layer of skin and fur on their body)

What difference do you find in the structures of leaves in the plants of mountain regions and plants that grow in plains?

Chart of pines and cedar,
Chart of sheep and yak



SHEEP



PINES

CEDAR

YAK

Some plants and animals of mountain region

Help them to infer that animals like sheep and yak, have a thick coat of hair on their bodies to protect them from cold. Many plants like pinus have pointed needle-like leaves. (Needle-like leaves provide least resistance to the force winds).

Activity 7

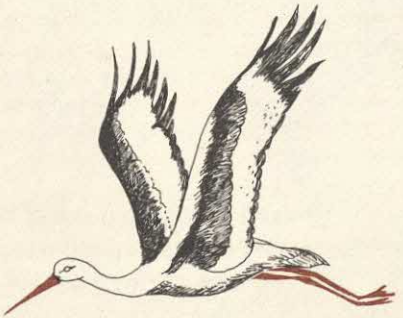
Identify the characteristics of animals which can fly

Show the chart/specimen of a flying bird.
Ask them:
Name some animals that fly in the air. (Birds and bats, etc.)
Why can you not fly without any external aid?
What features in the body of a bird help to fly?
(Wings and light weight of the body)
In what respects do the shapes of a bird and an aeroplane resemble?
(They both have streamlined bodies i.e. narrow in the front and at the back, and broad in the middle, or we may say boat-shaped)

Help them to infer that birds have special body features like wings, feathers and a streamlined light body which enable them to fly.

Chart of some flying birds showing the external features

Chart showing pictures of an aeroplane and a flying bird



Flying bird

Aeroplane

E 1

Ask the students to observe minutely the movements of birds, fishes, camels and sheep in their surroundings.

E 2

Ask the students to observe water plants, cactus, palm trees and other terrestrial plants and note down their special adaptations with their habitat/the natural home of an animal or plant.

E 3

Encourage the students to construct a terrarium with the help of instructions given in section III of this handbook. Ask them to observe the movements of small animals like earthworm, snails and frogs, etc.

1.4: Do all seeds of a plant grow into new plants?

Focus on: All seeds do not grow into plants

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify that all seeds do not grow into similar plants	Activity 1 Ask the students : Why do all the seeds produced by a plant not get a chance of growing into new plants? Help them to understand that a plant produces many seeds but all of them are not able to germinate and grow up into new plants, because some are destroyed by natural agencies like wind and rain, while some others are destroyed or eaten by insects and animals.	Soil, mustard, gram and bean seeds

Ask students to take a counted number of seeds of mustard, gram and beans, and sow them in the soil or in the pots separately.

Let the seeds grow into seedlings and the seedlings into young plants.

Ask students to observe and compare the external features of one group of plants, e.g. gram or bean with the other group of plants, e.g. mustard. Let them also observe five or six plants of the same type (e.g. mustard) and note down their similarities that characterise them from other plants.

Ask them:

How do the plants of one group differ from the plants of another group?

How do the plants of any one group look similar to one another?

What similarities do you observe in the plants of the same group?

Help them to infer that seeds of the plant grow up into the similar plants.

E 1

Take two pots A and B. Sow some healthy seeds of bean or maize or may be any other seed which are available in their surroundings in pot A and some unviable/damaged seeds of the same variety in pot B. Water them regularly and observe their growth after 10-15 days and discuss the result.

Two pots, bean/maize seeds

E 2

Take five seeds of gram, mustard and beans and sow them in a pot with garden soil. Water them regularly,and observe their growth after 10-15 days. Compare their structures with the plants of the same type grown earlier in activity 1.4.1 Discuss the results.

Seeds of gram, mustard, bean

1.5: What are the conditions necessary for germination?

Focus on: Conditions necessary for germination

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify conditions necessary for germination

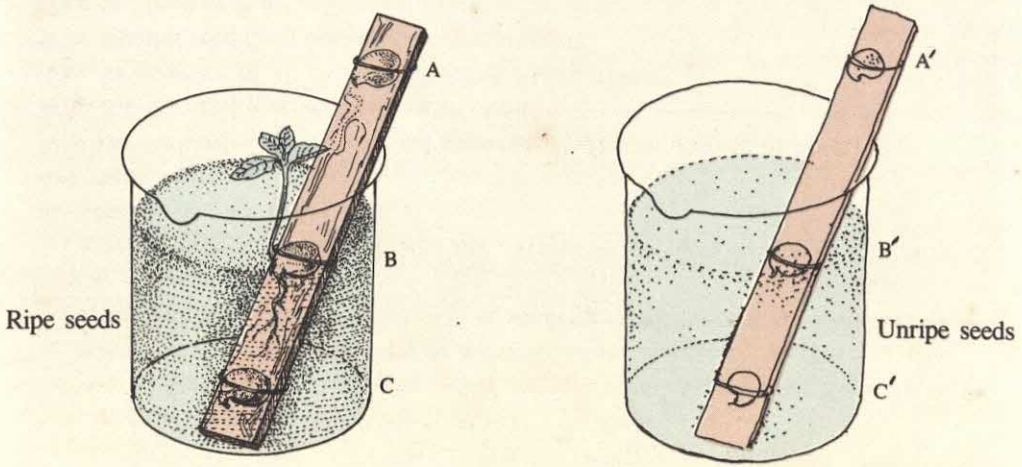
Activity 1

Ask students to take three ripe (healthy) and three unripe (unhealthy) seeds of beans.

To distinguish between healthy and unhealthy seeds, put all the seeds in a beaker containing water. Unhealthy seeds are generally lighter in weight and are therefore likely to float in water and healthy seeds are likely to settle down.

Fix the seeds on a wooden/plastic strip or straw pipe with the help of a thread or a rubber band separately as shown in the figure. The beaker containing ripe (healthy) seeds is to be marked I and the beaker containing unripe (unhealthy) seeds to be marked II.

Three healthy and three unhealthy seeds of beans, thread or rubber bands, wooden strip, two beakers, water cooled after boiling, oil



Necessary conditions for germination

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Place the wooden strip with seeds fixed on it in beakers containing water, cooled after boiling it (to get rid of dissolved air present in water).

Make the level of water touch the middle of seeds in both the beakers. Name the seeds A, B and C respectively from top to bottom.

Put some drops of oil on the surface of water to check evaporation and entry of air into it.

Leave the experiment for 6-7 days and observe the changes that have taken place in the seeds.

Ask them:

Why has the seed A in beaker I not germinated? (Due to absence of water)

Why has the seed B in beaker I germinated?

(Due to presence of air, water and suitable temperature)

Why has the seed C in beaker I not germinated?

(Due to absence of air)

Why have all the seeds in beaker II not germinated?

(Due to unripe and unhealthy seeds)

Help them to infer that air, water, and suitable temperature are necessary conditions for germination. Emphasise that only ripe (healthy) seeds, with desired conditions germinate.

E 1

Encourage the students to repeat the activity 1.5.1 by taking seeds of another type (ripe and unripe); and using plain water instead of the one cooled after boiling. Do not add oil drops but maintain the same level of water by adding plain water (if required).

Keep the apparatus for a week and note down the changes that occur in the seeds and discuss the results.

E 2

Take four *katories*/empty cans or any other container available and label them A,B,C

and D. Place cotton/muslin cloth/newspaper/blotting or filter paper in all the four containers and put a few bean/gram/*moong*, etc., seeds in all the four containers.

Moisten container A sufficiently so that seeds get good supply of both water and air. The container is kept at normal temperature.

In the container B do not put any water and let other conditions remain the same.

Put enough amount of water in container C. Put a few drops of oil on the surface to avoid entry of air.

Moisten the container D and keep it into the refrigerator (any other colder place available) to avoid the right temperature.

Observe the germination of the seeds in all the four containers after a few days and note down in which of the containers germination has taken place.

Note down the conditions missing in the containers in which germination has not taken place.

Four *katories*/empty cans, muslin cloth, newspaper or cotton/filter paper, bean/gram/*moong* seeds, water, oil

1.6: Are sunlight, minerals and water necessary for the proper growth of the plant?

Focus on: Conditions necessary for the growth of the plants

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify the conditions which facilitate the proper growth of the plant

Activity 1

Ask students to take four young plants of the same kind and age, and plant two of them separately in two pots A and B containing garden soil. Plant the other two (one each) in pots C and D, containing washed sand or crushed pebbles.

Keep the pots A and C in dark. Keep the others i.e. B and D in sunlight.

Water them regularly. Observe the growth of plants after 10 days.

Ask them:

Which set of plants has healthy growth and why?

Four young plants, pots, garden soil, pebbles, water, stones and sand

In the set of B and D, which plant has a healthy growth and why?
What will happen if plants are not watered regularly?
Help them to infer that plants need sunlight, minerals and water for their proper growth.

E 1

Take two potted plants. Keep one of the plants in dark and the other one in sunlight. Water both of them regularly.

Observe their growth after a week. Now stop watering them and again observe the growth after a week. Discuss.

Two potted plants, water

1.7: Do variations exist in the rate of growth of seedlings under similar conditions?

Focus on: Variation in growth of seedlings under similar conditions

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify that variations exist in the rate of growth of seedlings even under similar conditions	Activity 1 Ask students to sow some seeds of the same variety of *rye/moong/*gram or beans in a broad and shallow container having garden soil. Let them observe the length of seedlings after 4-5 days. Ask them: Are all the seedlings (or young plants) of the same length (size)? How do they differ? Help them to infer that variation exists in the growth of seedlings, though they are under similar conditions. This is because the seeds of the same plant differ in their food contents; and this is too a factor that determines their growth.	*Rye/moong/*gram/beans seeds, broad and shallow container

E 1

Repeat the activity 1.7.1 by taking different varieties of the same kind of seeds e.g. different varieties of bean or of pea.

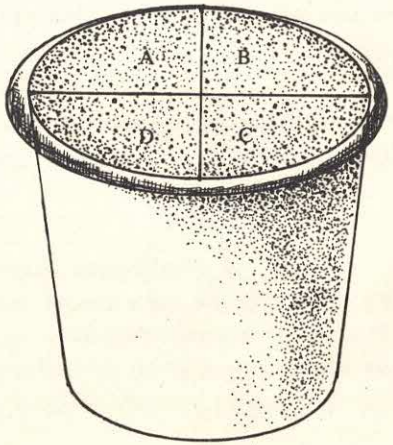
Varieties of bean or pea

Observe and note down the differences, if any. Discuss.

E 2

Take some healthy seeds of gram or any other seed. Sow them in one pot, one each at the four different places A, B, C and D (see figure) to maintain certain distance. Water them regularly and observe their growth. Compare the lengths of the four seedlings.

Pot, gram seeds



UNIT 2: HUMAN BODY, NUTRITION AND HEALTH

(The bone cage-our body and its movement; Dificiency diseases; Communicable diseases; Community sanitation)

Introduction

In class IV the students have studied that the major internal organs of human body are lungs, heart, stomach and liver. They are also aware of their functions. They have studied about the different organs of the digestive system and the process of digestion. They are also familiar with the types of food stuffs and have learnt proper methods of storing, cooking and serving food. They understand how food is contaminated and also know the ways of preserving food. They recognise impure water and the causes for impurities and the ways of purifying water. They are also familiar with the causes which make the surroundings unhygienic.

In this Unit, the students will be able to

- identify the different bones in the human body,
- identify that bones give a definite shape to the body and also protect the delicate organs of the body,
- identify the different kinds of joints and the movements made possible through them,
- identify the muscles in the body and their major functions,
- recognise the voluntary and involuntary muscles and their functions,
- recognise the factors leading to proper development of muscles and importance of exercise in the development of muscles including the advantages of sitting in right postures,
- establish relationship between the intake of food, the age and occupation of persons,
- identify and classify different food items into energy-giving, body-building and protective food,
- identify causes of deficiency diseases and common deficiency diseases with special emphasis on anaemic and eye defects,
- identify that consumption of reasonable amount of food, protects us from deficiency diseases,
- identify common food practices of his/her locality and clarify their positive and negative aspects,
- recognise the need for preservation and storage of food and proper methods for storing food and foodgrains,
- identify different factors which contribute to spread of communicable diseases,
- identify causes and prevention of insanitary conditions,
- recognise the steps which can be followed to keep the environment clean.

2.1: What are the functions of skeletal system?

Focus on: The functions of skeletal system in human body

(4-5 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify different bones in the human body	Activity 1 Let the students feel their bones of wrist, collar, fingers, face, legs, etc. How do you feel? (We feel something hard inside) Show them the chart of a skeleton. Help students to infer that the human body is made up of different bones. Collectively it is called skeleton.	Chart of human skeleton

Human skeleton

Identify that bones give definite shape to our body

Activity 2

Let the students trace the outline of their hand on a piece of paper with a pencil. Paper sheet, pencil

Ask them to compare the shape and size of the figure they have traced out with that of their classmate.

Help them to infer that the shape of all human beings is more or less similar although the humans differ in their size. This shape of the body is due to the bones present inside.

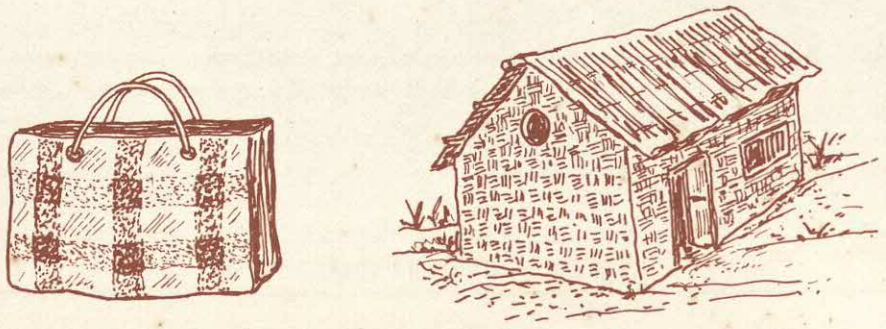
Activity 3

Show an empty bag and compare it with the human body without a skeleton. Empty bag, hanger

Then put a hanger inside and show them that the bag has now a shape.

Help them to infer that our body will not have a shape without skeleton, just like the empty bag. With a skeleton the body gets a definite shape (like the bag with a hanger inside).

Cite other examples-a tent without the central pillar, and a hut without a frame, which will not have any shape without the supporting framework.



Bag and hut with supporting framework

Activity 4

Identify that bones protect the delicate organs of our body

Ask students the following questions:
Why do the television and radio have an outer cabinet?
What will happen if the T.V. or radio has no cabinet?
What will happen to the nib of your pen if it falls with the cap on? (It will be protected)
What will happen to the nib of your pen, if it falls without the cap? (It breaks)
How does the cap of a fountain pen protect the nib? (The cap acts as a shield for the delicate nib)
Cite other examples, e.g. in villages, the haystacks protect the grains in the field from rain and wind.
By comparing the following facts elicit from the students:
Our bones protect our delicate body organs, e.g. the skull protects our brain, the body cage of chest protects our lungs and heart, the back-bone protects our spinal cord.
What would happen if there are no bones in our body?
Ask students to infer that without bones, our body will not have a definite shape.

Activity 5

Identify different joints of bones and movements made possible through them

Open an umbrella in front of the students. Umbrella
Ask them:
What do you see on the inner side of the umbrella? (Spokes)
What is the use of these spokes in the umbrella?
What has given a definite shape to the umbrella?
Help students to compare the umbrella with the human body and infer that the spokes, like the bones, support the system (the umbrella) to which they are giving a definite shape.

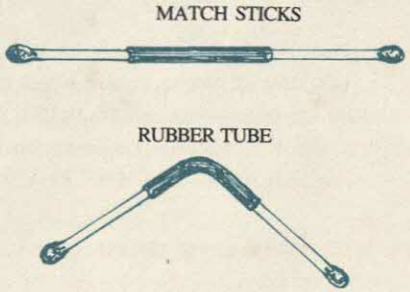
Umbrella with spokes

How are umbrella spokes joined together?
Why are they jointed?
Do you see that these resemble the bones in our body which are also jointed?
Help students to infer that the joints help us in flexible movement of the body parts.
Ask students to touch their shoulder with their hand.
Where does the forearm bend from?
Why?
Imagine that your arm is without a joint, will you be able to touch your shoulder then? (No)

Activity 6

Take a big and a small stick of dry thin twig of a tree or two match sticks and join them with the help of a rubber tube/cellotape as shown in the diagram.

Dry twigs, rubber tube/cellotape. sticks (big and small)/match sticks



Bending of matchsticks from a joint

Try to bend the bigger stick, the one without a joint. (It will not bend but will break into two pieces). Try to bend the other stick from a joint. (It will be bent easily due to the joint in between).

Move your arms up and down a few times and show that the movement is possible because of the joints.

Ask students to bend the arm at the elbow and then move it at the elbow and also move it at the shoulders.

Draw out from the students a comparison of the human bone joints with activities done here and elicit from them the conclusion that joints in the bones help in greater manoeuvrability (efficiency in movement/skilled movement) of the human body.

Activity 7

Ask the students to bend and stretch their arms. Also make them open and shut the door.

What is the similarity in the two movements?

Help them to make a comparison between these two one-way movements. Let them compare this movement with the swinging of their arms at their shoulders.

Ask the students to locate similar joints in their knees, hips, etc.

Ask students to cite more examples of this kind.

Activity 8

Identify the major functions of the muscles

Ask students to bend their arms at the elbow and feel the muscles of the upper arm.

What was the state of the muscles when the hands were straight?

Why did the muscles bulge on bending the arm?

Point out that the movement of the arm is due to the contraction and relaxation of the muscles. Also make them understand that muscles help in movement of the body and its parts.

Activity 9

Identify muscles as voluntary and involuntary

Let students close their eyes, open their eyes, smile, put their hands up, down, side ways and stop moving them.

Ask:

Are these movements under your control?

Help the students to understand that some movements such as those of the muscles of heart, stomach, intestine etc., are not under their control (involuntary) whereas the movement of the some other muscles is under their control (voluntary).

Introduce the vocabulary-voluntary and involuntary.

Ask students to make a list of activities/movements (of their bodies) which are under their control and also those which are not under their control (e.g. blinking of eyes). Record in table.

Type of muscular movement	Voluntary	Involuntary

Recognise the factors leading to proper development of muscles

Activity 10

Take students to the field and ask one student to throw a stone with all his might, first with the right hand and then with the left hand. Mark the places where the stone falls.

Stone

Ask them:

Why is the distance of the stone thrown by one hand more than that of the other?

Point out that the muscles of the hand that was able to throw the stone for a longer distance, were put in continuous and frequent use and thus become stronger and more developed. The muscles of the other hand which was not used so often, are not so strong and developed. Sportsmen, atheletes and wrestlers do exercise to strengthen their body muscles.

Draw conclusion that the more we exercise our bodies the muscles become stronger and this is why swimmers and runners have stronger muscles. Atheletes spend much time on training in order to strengthen their muscles.

Activity 11

Show the pictures depicting correct and wrong postures (of both sitting and standing) and ask the students to differentiate between good and bad postures.

Pictures of correct and wrong postures while sitting and standing

Now explain the correct posture by showing the pictures to the students.

Ask:
What is the correct distance for reading? (About 30 cm)
What happens when the posture is not correct?
(Hunchback, bulging of belly and eye defects)

Ask students to practise correct posture for sitting, standing and reading. They should also be encouraged to do regular exercise to develop their muscles and keep fit.

E 1

Ask students to collect pictures of sportsmen, wrestlers and weight-lifters etc., whose muscles are well developed.

2.2: What is the relationship between the intake of food with age and occupation?

Focus on: Relationship between age, food intake and occupation of the person

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Establish relationship between the intake of food with occupation and age of person

Activity 1

Ask students to observe the intake of food of infants (at home or elsewhere) and children of different ages, of adults and of very old people. They should also find out the interval between their meals.

Help them to infer from this that an infant takes small quantity at shorter intervals, and the quantity as well as the interval increases progressively with age, and reaches perhaps its peak where person is a young adult. As old age approaches, the quantity of food intake decreases.

Recall the previous learning of the students by asking the following questions:
Why are children given more milk/food rich in body-building materials?
Why are old people advised to take less of energy-giving food?

Point out that children need more of body-building food for proper growth of their body.

Draw the attention of students towards their observation in daily life and ask the students:

Will a labourer, generally, eat more food or a person sitting and working in an office? (The labourer, because he spends more energy as compared to the person sitting and working)

Draw their attention to the fact that the intake of food differs according to occupation of the people. The person engaged in manual work needs more food and the person engaged in mental work needs less food.

Again recall the previous knowledge of the students by asking the following questions:

Why do we need food? (For energy, growth, repair of tissues and protection from diseases)

Who requires more food items essential for growth? (Children)
Why does your mother insist you to drink milk twice/thrice a day?
(Milk is rich in body-building materials, which is most needed by children)
What are the other food items rich in body-building materials? (Milk, milk products, cheese, curd, pulses, groundnut, egg, fish, meat)

E 1

Ask the students to:
—make a chart/collect pictures of food items rich in body-building materials.
—collect various pulses, put them in plastic bags and staple them on a chart.

2.3: What are the deficiency diseases?

Focus on: Causes and prevention of deficiency diseases

(3-4 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Recognise the need of taking sufficient amount of food and with all groups present in the proper proportion

Activity 1

Test the previous knowledge of the students with the help of the following questions:
Which is your favourite food?
Why do we need food?
What are the three kinds of food stuffs?
(Body-building, energy-giving, protective foods)
What did you take for breakfast?
Was it body-building food, energy-giving or protective food?
What will happen if you eat insufficient amount of food?

(We will feel weak, and not be able to work and play)
Ask students:
What food do you take in your daily meal?

Activity 2

Ask students to make a daily food chart of their food and see if they are consuming adequate amount of food from the different groups.

Balanced diet chart

Food groups	Breakfast	Day meal	Dinner
Energy-giving food (Cereals, fats, oil, sugar etc.)			
Body-building food (Eggs, milk, soyabean, pulses etc.)			
Protective food (Green leafy vegetables, fruits etc.)			

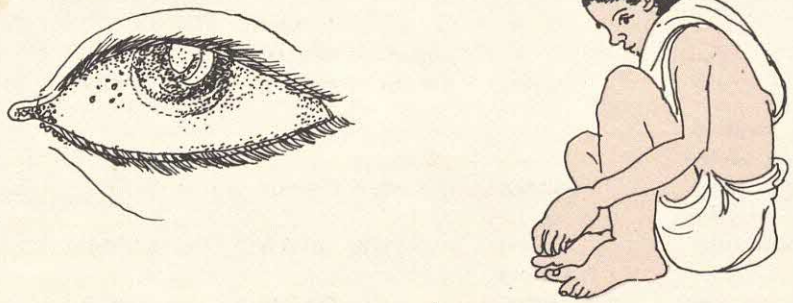
Analyse the food chart of each student and compare it with a balanced diet chart. Find out if he/she takes adequate food having all the three types of food.

Identify the causes of deficiency diseases

Ask the students:
What would happen if you go on taking sweets only?
What would happen if you go on eating pulses only?

Chart on different food items for vitamins and their deficiency diseases

What would happen if you do not eat fruits and vegetables?
Make and show the vitamins chart.
Make them understand that fruits and vegetables contain vitamins and minerals which help to protect us from the diseases.
What are the diseases caused if Vitamin A and Vitamin B are not in the diet?



Diseases caused by the deficiency of Vitamins A and B

Identify common deficiency diseases

Point out that it is necessary to take food containing body-building, energy-giving and protective foods. Taking only one type of food causes various deficiency diseases.

Ask students to name some of the diseases they know of. Make them understand with the help of the following table that these are the common deficiency diseases, which are caused by the deficiency of some kind of food.

Deficiency diseases, their causes and remedy

Cause	Disease	Symptoms	Deficiency of	Curative food
Lack of protective food	Goitre	Swelling of thyroid gland	Iodine	Iodised salt
	Scurvy	Bleeding of gums	Vitamin C	Lemon, citrus fruit
	Beriberi	Spots on the body and swelling in legs and bow legs	Vitamin B complex	Green vegetables and fruits
	Rickets	Bow legs	Vitamin D and Calcium	Milk and sun-bath
	Anaemia	Pale body skin	Iron	Leafy vegetables and fruits
	Night blindness	Blindness in dim light	Vitamin A	Carrot, eggs, ripe mango, papaya, pumpkin
Lack of body-building food	Kwashiorkor	Retarded growth, hair and body skin without lustre	Protein	Egg, meat, pulses, milk
Lack of energy-giving food	Marasmus	Gradual loss of flesh and strength	Carbohydrates, fats	Sugar, oil and ghee, cereals

How do you feel when there is a heavy loss of blood? (Weakness)

Activity 3

Identify the causes of anaemia and eye defects

The deficiency of blood causes a disease called anaemia. This is mainly due to inadequate consumption of iron rich food.

Point out the importance of green leafy vegetables and fruits. They contain the iron

necessary for the formation of the blood and for protection from various diseases.
Can you see in the dim light at night?
Do you eat green leafy vegetables?

Explain to the students that inability to see in dim light is a disease called night-blindness which is caused due to the lack of intake of green leafy vegetables and yellow coloured vegetables and fruits in the diet, for example-mango, carrot, papaya, pumpkin. Tell them that this would also cause anaemia.

E 1

Ask students to collect naturally-coloured pictures of fruits and vegetables and paste them in their scrap note books.

2.4: What are the common food practices and beliefs?

Focus on: Common food practices and beliefs in the community

(3-4 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise the common food practices in different communities	Activity 1 Ask students to open out their tiffin boxes and state what food they have brought for the meal. (Rice, *puri, chapati, dosa, idli,* sweets or fruits) Help students to classify their food according to the communities where they are commonly consumed.	

Fill in the following table:

Food	Community
Idli	South Indian
— — —	— — —
— — —	— — —
— — —	— — —

Help them to infer that food habits are different in different communities.

Identify some of the food practices essential for maintaining good health

Activity 2

Ask students:

What does your mother give you when you have a loose stomach? *(Khichri)*
How do we cook *khichri?* (By boiling)
How do you feel after eating *khichri?* (Comfortable)
Help students to infer that boiled food is easier to digest. Explain that boiled food has more vitamins and preserves the nutrients in a form which are easily digestible.

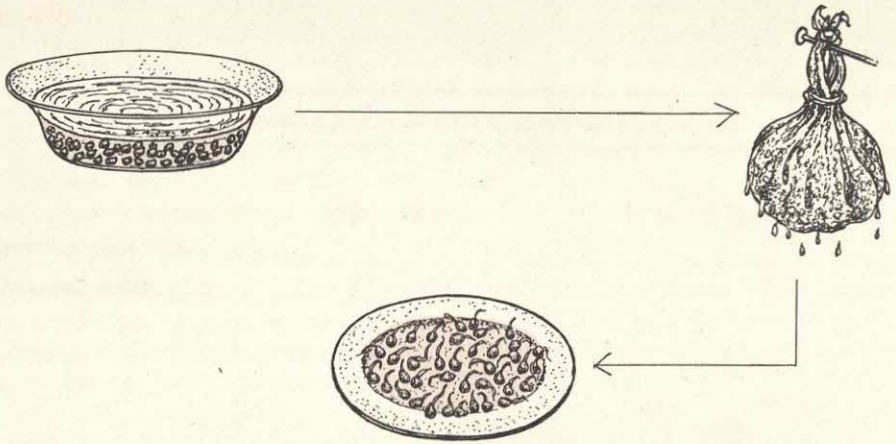
Activity 3

Bengal gram, cotton cloth, potable water, bowl/container

Ask students to take a small bowl and soak a handful of bengal gram (*chana*) in it for 8-10 hours. Drain the bengal gram in a cotton cloth and tie loosely. Keep it in a place till it sprouts.

Encourage the students to do the same activity with wheat, maize, *bajra, jawar* and pulses like *moong, urad* and *rajma* at home.

Explain to them that sprouted grams have high nutritive value and should be taken regularly.



Sprouting of seeds

E 1

Ask students to soak in water, one cup of rice and one-fourth cup of *urad*. Grind them separately in the morning and then mix them. Leave it for five hours for fermentation. Put it in small *katories* and steam. After steaming, eat them. This fermented food contains more vitamins.

Water, rice, *urad*, grinder, container, *katories*, burner

E 2

Ask students to cut and boil vegetables like carrot, beans, cauliflower. Sprinkle salt, pepper and add lemon juice. Students should be made aware that boiled vegetables contain good quantity of vitamins and minerals.

Vegetables like carrot, beans, cauliflower; salt, pepper, lemon juice

E 3

They could make *chat* out of sprouted gram by mixing with lemon juice, salt and pepper. Explain to the students that even boiled and sprouted food is delicious.

Sprouted gram, lemon juice, pepper salt

Activity 4

Identify bad food practices in the locality

Discuss:

Cooking food only once a day, and then eating at all meal times (breakfast, lunch, dinner) is convenient/good/bad.

Eating foods of one kind all the time and in different forms (such as potatoes, maize and rice) should be discouraged. (Unbalanced diet)

Take diet without roughage, made available by fruits and vegetables, in our diet is harmful.

2.5: What is the need of preserving food?

Focus on: Various methods of food preservation

(3-4 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Recognise the need for preservation and storage of food

Activity 1

Draw the attention of the students towards their daily observations and ask:

Name some vegetables/fruits available in the summer.

What are some of the fruits/vegetables available in plenty in the winter?

Point out to them that fruits and vegetables being seasonal and capable of getting spoilt fast, should be preserved and used in the future.

Activity 2

Peas, mangoes, lemon, bread, *palak*, potatoes, magnifying glass hand lens

Ask students to take a seasonal fruit and vegetable and keep them aside for a week. Take a piece of moist bread, potato or *palak* and keep it in a dark corner of the room. After 3-4 days ask students to observe and notice the presence of some black spots with the help of a magnifying glass/hand lens, the growth of fungi and spoilage of food. Help them to infer that food stuffs should be stored and preserved properly.

Activity 3

Identify the proper methods of storing food grains

Discuss on the proper methods of storing food grains.
How does your mother store pulses and cereals at home? (In boxes, i.e. in air-tight containers)
What does she put inside the containers before storing the food grains?
Ask students:
How does your mother preserve fruits and vegetables?
How can you eat mangoes in winter? (In the form of pickle)
Name some other food items that are preserved and eaten in seasons other than those in which they are available.

Activity 4

Recognise various methods of preserving food items

Dried vegetables like cauliflower, chillies, mint and coriander

Discuss with the students, the different methods of preserving food items.
Dehydration: Show the students some sample of dehydrated (dried in the sun-shine) fruits and vegetables like chillies, cauliflower, coriander or mint leaves.
Why are food stuffs not spoiled on dehydration?
(Since the moisture is absent, the microbes (tiny living organism) which are not visible to the naked eye, fail to grow, and the food items are therefore not spoilt)

Activity 5

Two containers, milk

Boiling: Place equal volume of milk in two containers. Boil the milk in one container and leave the other as such. By the end of the day observe and find out which

one has turned sour. Make the students understand that boiling preserves food for a short period.

Activity 6

Preservatives:

(a) By using salt

Ask students to bring a lemon cut into four pieces. Put these in a jar along with salt, and leave it in the sun-shine for 4-5 days. Place a lemon next to the jar without putting salt. (This lemon is spoiled and the other lemon is ready for use as a pickle). Explain that because of the addition of salt, the lemon is preserved.

Two lemons, salt, jar

Activity 7

(b) By using sugar syrup

Ask students:
What is jam/jelly?
Why does jam/jelly taste sweet?
Why does fruits remain safe for a longer time in the form of jelly/jam?

Help the students to understad that preservatives like salt, sugar, vinegar are natural preservatives. Also there are some artificial preservatives like glacial acetic acid and sodium benzoate, which are used in jams, sauces etc., as preservatives.

Activity 8

Identify that low temperature maintains food-quality and preserves foodstuffs

Make students understand that microbes fail to grow in concentrated sugar solutions and that storing at low temperature also preserves food.
Ask:
In which season does food get stale soon?
Why does food not get spoiled so soon in winter?
Why does milk not turn sour so soon in winter?

Help them to infer that storing food at low temperature prevents it from decay. Refrigerators/improvised fridges have low temperature and so the food remains fresh and does not get spoilt soon.

E 1

Improvised fridge

Take an earthen pot. Fill one-fourth of pot with moist sand. Cover the pot with moist cloth. Now if foodstuffs are kept in it, they won't get stale soon.

Earthen pot, sand, cloth, water

E 2

Ask the students to store seasonal vegetables like turnip, cauliflower, chilly etc., by dehydration.

Ask students to prepare jam/jelly in the school. They could preserve carrots, *amla*, apple, in sugar syrup. This could be extended to 'learn while you earn' projects.

Seasonal vegetables, fruits, sugar, bottles/cans (to store *morabbas)*

2.6: What are the factors for the spread of communicable diseases and measures to prevent them?

Focus on: Causes and prevention of communicable diseases

(2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify factors which contribute to the spread of communicable diseases	Activity 1 Ask the students: What are communicable diseases? Help students to understand that some diseases are transmitted from one person to another. These are called communicable diseases.	

Draw the attention of students to their day-to-day experience and ask the following questions:

What are the various things you use in the bathroom?

Do you use the same things in your kitchen?

Why?

(Unhygienic, passing of germs of various diseases)

Why are you advised not to drink water in the glass used by any other person?

(He may be suffering from a certain disease or carrying germs of a disease)

Why are you not allowed to go near one who is having chicken-pox or mumps?

(You might catch the same disease)

Help the students to understand that use of infected food, water, air and clothes or by touching an infected person, or going near him causes infection.

Identify common diseases prevalent in the locality

Ask students to name some of the common diseases in their locality.

(The common diseases are: common cold, influenza, chicken pox, measles, mumps, dysentery, diarrhoea)

Identify communicable diseases

Which of the above mentioned diseases will spread from one person to another?

(Eye flu/conjunctivitis, measles, chicken-pox, mumps, diarrhoea)

Identify the ways of spread of communicable diseases

Ask the students:

How does malaria spread?

(It spreads through bites of certain mosquitoes)

While sneezing and coughing, why are you asked to cover your mouth?

(You can transmit the germs)

Are any germs present in the atmosphere?

(Yes, germs are present in the atmosphere)

What will happen if a mad dog bites?

(It will cause rabies)

How do these diseases spread?

(These communicable diseases spread through air, water, food, direct or indirect contact and the bite of insects or other animals)

Identify measures for preventing spread of communicable diseases

Ask the students:

Why are children suffering from measles kept separately?

Why should hands be washed before eating or after any contact with a dirty article?

(To prevent the spread of germs)

Why are people advised to boil drinking water when there is a threat of an epidemic (when a number of people are suffering from the same disease at a certain place for a certain period of time)?

(To prevent the spread of diseases)

How can these communicable diseases be prevented?

(Precautions help to prevent the spread of communicable diseases)

Why are we asked not to eat exposed food from the market and street-side vendors?

(The germs present in the air contaminate the food. Flies sit on the exposed food and pass on various germs)

What will happen if you drink dirty water?

(Contaminated water will cause diseases like jaundice, cholera and dysentery)

Help students to infer that by protecting food, water, air and clothes from being infected, the communicable diseases are prevented from spreading.

Identify steps to be taken to prevent the spread of communicable diseases in the community

Ask the students:

Why do you keep your handkerchief on your nose when you pass through a public urinal?

(Foul smell)

What do you observe near open drains and dirty ponds in your locality? (Flies, mosquitoes)

Help the students to infer that the surroundings must be kept clean, and water shall not be allowed to accumulate around the house.

2.7: What are the factors that contribute to insanitary conditions in the community and the steps to prevent them?

Focus on: Factors contributing to the causes of insanitary conditions and methods of prevention

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise the relationship between sanitation and health in the community	Activity 1 Draw the attention and discuss with the students about their surroundings and recall their previous learning by asking the following questions: Where do you throw the garbage in your house? (Outside the house at proper place or in a dustbin) What happens if the garbage is not thrown in the dustbin? (The house gets dirty, there are flies and diseases) Where do your neighbours throw the garbage? Where is this garbage of different houses collected? What happens at such places where garbage is accumulated uncovered? (There will be pigs, dogs, flies, mosquitoes, crows, cattle, etc.) How do such places smell? (Foul smell) What do you see near an open drain/stagnant water? (Mosquitoes, flies, dirt, etc.) What do such conditions lead to? (Spread of diseases like malaria, cholera, dysentery) What happens if people vomit, spit on the road sides, buses, public parks or defecate in open spaces? (This will lead to spread of communicable diseases like tuberculosis, diptheria, dysentery)	
Recognise the steps to be taken for keeping the environment clean	Activity 2 Discuss on the following points on how to prevent insanitary conditions. 1. Not only your own house should be kept clean but also its surroundings. Garbage should be kept in covered dust-bins.	

2. Do not allow people to defecate in the open near the houses.
3. Everyone should use the urinals rather than urinating on the roadside.

Activity 3

Ask them to prepare posters and put them up in the school and in their locality. Here are some examples:

—THROW GARBAGE IN COVERED DUSTBINS
—DO NOT SPIT ON THE ROAD SIDES
—KEEP YOUR ENVIRONMENT CLEAN TO REMAIN HEALTHY

E 1

Ask students to organise a cleanliness week in the school and in the locality with the help of elder children.

Help students to appreciate that these two activities will create an awareness amongst the people and make them realise the need for a clean, healthy environment.

E 2

Encourage the students to collect bottles, cans and lids, etc. Ask them to bring these to school. They should be guided to use these things by making items like flower vases, pots, dustbins, pen holders, and spoon holders.

Waste materials like bottles, cans and lids, worn-out clothes

Encourage the students to use worn-out clothes to make:

— Clowns, dolls
— Table cloth, sheets, etc.

E 3

Prepare gobar-gas by taking cow dung and mixing it with equal amount of water. Put the mixture in a can and cover it. Keep it for 7 to 8 days. On opening the can, foul smell will come. Visit a bio-gas/gobar-gas plant nearby.

Cow dung, can, water
Picture of a typical bio-gas plant

UNIT 3: SOIL EROSION AND ITS CONSERVATION

(Soil conservation)

Introduction

In class IV, the students have studied the formation and the types of soil (sandy, loamy and clayey). They are able to recognise similarities and differences in three types of soil. They have also learnt the composition of soil and are able to recognise the various ways to make the soil fertile viz., manuring by compost, adding chemical fertilisers and by crop rotation in order to get good crops and higher yields. They recognise that the sowing of the crops in proper seasons, manuring and watering them properly, and protecting them against diseases are the factors contributing to increased crop yield.

In this Unit, the students will be able to

— recognise various factors that contribute to soil erosion,

— recognise various ways in which soil is conserved.

3.1: What are the different factors that contribute to soil erosion?

Focus on: Causes of soil erosion

(3-4 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the role of water in soil erosion	**Activity 1** Ask students to take a shallow tray and fill it with soil. Tilt it and pour water on it with the help of a beaker. Ask: What do you observe? Help students to observe and infer that water exerts a force on the soil particles, which carries away particles from a higher level to a lower level. This is how soil is washed	Shallow tray, soil, beaker, water

away or eroded by rains and running water in nature.

Moving water carries away soil particles

Recognise that water flows ahead in channels to irrigate the fields

Activity 2

Take a shallow tray. Put soil in it. Make small channels for flow of water. Pour water in the channels and observe.

Shallow tray, beaker, water, soil

Ask students the following questions:

What change do you observe in the channel through which water is moving?

(It has widened by the force of moving water)

Where does this soil go?

(It settles in the field)

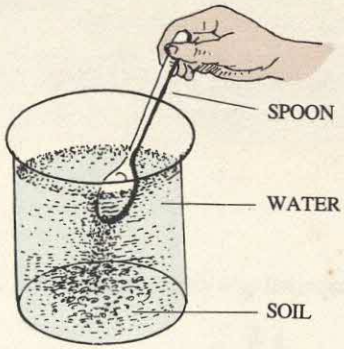
If possible, take them to a field which is watered through channels.

Recognise that moving water carries soil particles and deposits them in different places

Activity 3

Ask a student to take a beaker; put some water and soil (two spoon-ful) in it and stir it with a spoon. Leave it for some time after stirring.

Beaker, soil, water, spoon



What do you observe when we stir it continously?
(There is water in movement and the soil particles are seen floating in it)
What happens when we stop stirring? (Soil particles start settling at the bottom)

Explain that, in nature, rivers flowing from the mountains bring soil with them and deposit it in the plains, making them fertile.

Activity 4

Recognise that moving air carries soil particles and deposits them in different places

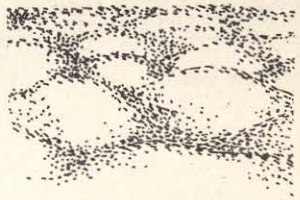
Ask students to take a piece of paper and put some powdery soil on it. Let them blow air by mouth/hand fan.

Paper, soil, hand fan

Ask students:
What do you observe?
What caused the soil particles to disperse?
Where do these soil particles go?

Help students to infer that the lighter and loosely packed particles from fertile top soil, are removed by the blowing air.

Moving air carries away soil particles



SAND DUNES

Picture of sand dunes in deserts

Recall the activity in which we blow powdery soil with a hand fan.
What happens to the powdery soil when we blow/fan it?
(It is blown away with the moving air)

With the help of the picture of sand dunes in a desert, help students to recognise that these dunes are formed by the sand which is carried away by wind at one place and deposited at the other.

Activity 5

Recognise that deforestation leads to soil erosion

Ask students the following questions:
What happens when you continuously walk over the same area of a grassy land? (The

grass gets crushed and then dries up, exposing the top soil which then cracks or breaks)
What will happen to the exposed top soil if there is a strong breeze or rainfall? (Soil is carried away by wind or moving water)

Explain that, in nature, plants, trees, grasses, crops etc., bind the soil particles. Thus they check/prevent soil erosion. Recall the functions of roots and ask students:
Where do we use wood?
How is wood obtained from forests?
Explain that the cutting down of trees is called deforestation. It is mostly done to get wood for domestic purposes or for increasing land area for agriculture.
How does deforestation affect our lives?
What are other consequences of deforestation?
Explain that the deforestation leads to soil erosion and green belts of land will convert into barren/waste lands.
Ask the students:
What are the other ways to maintain the land area under forest if deforestation cannot be completely stopped?
Why are we advised to celebrate *'Vana Mahotsava'?*

E 1

Suggest the students to grow more plants in school premises or in their surroundings.

3.2: What are the ways to conserve soil?

Focus on: The need and methods for soil conservation

(3-4 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise the need of soil conservation	Activity 1 Take the students to the garden or a nearby field and ask them to select a piece of land and divide it into two plots/beds. Ask them to remove the top soil of one part and	*Rye* seeds

leave the other half as such. Take some soaked *rye* seeds and sow them in both parts. Water them regularly. Observe for 3 days.

Ask them:

When did the seeds sprout?

(In two or three days)

Notice the growth of seedlings in both parts of land for 15 days.

What difference in growth do you observe in the two parts of land?

In which part of land are the plants healthier?

Explain that in nature, the top soil in fertile fields is removed by running water or dust storms and their fertility is thus reduced. This means that soil is amongst the most useful things of nature and it needs protection with utmost care.

The protection of the top soil from erosion by eroding agents such as wind, running water etc., is called soil conservation.

Activity 2

Identifying the methods of conserving soil

Draw the attention of the students towards healthy plants growing in their garden. What are the reasons for healthy growth of plants in a garden?

Help studens to recall the activity, 3.2.1, done earlier with *rye* seeds in which the top soil had been removed.

What was the effect of removal of top soil on the growth of plants?

Help them to infer that in gardens, one of the reasons, for healthy growth of plants is that top soil is intact.

Why does the top soil remain intact?

(It remains intact as the plants are watered carefully. Proper boundaries in gardens also help the top soil of the garden to remain intact).

Explain that by slowing down the movement of eroding agents viz. wind, water, etc., erosion can be checked to a large extent. Therefore, there will be less damage to valuable top soil and it will be conserved.

Activity 3

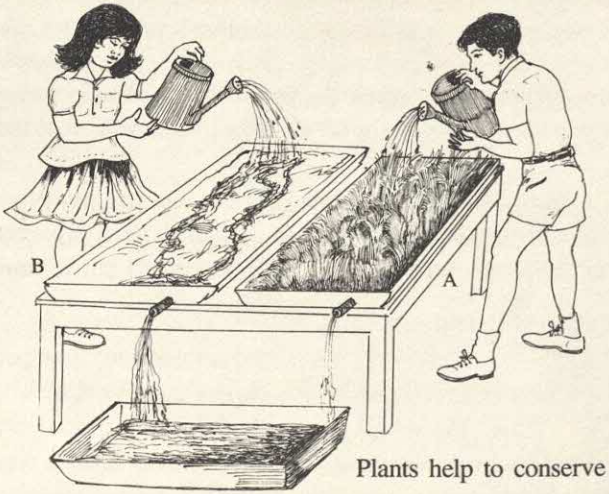
Identify the role of trees, grasses and plants in conserving soil

Two trays, soil with grass, soil without grass, beaker, two *katories*

Take two clods 15 cm x 10 cm x 5 cm from a field, one of them with grass and the other without grass. Take two trays and keep the one with grass in one tray A and the

other without grass in the other tray B. Tilt both the trays under running water or pour water with a beaker. Put one *katori* under tray A and one under tray B. Observe the clods in both the trays, as well as the water in both the *katories*.
In which *katori* is water turbid?
From which tray has more soil been washed off?

Help students to infer that trees, grasses, and plants help to conserve soil as their roots hold the soil particles in place. (Recall the functions of roots).



Plants help to conserve soil

Activity 4

Identify the ways in which bunds and embankments help to conserve soil

Draw the attention of the students towards drains over-flowing with water during rainy season.

Chart showing drains

How can the overflowing of drains be prevented?
(By raising side walls of the drains)
Discuss about the damage caused by floods in our country every year.
How can floods be controlled?
(By raising the stone walls on the banks of rivers or planting trees along the banks)

Explain that water exerts great force on the banks of rivers and therefore, soil at the banks of rivers and nearby farms is carried away with it. The bunds and embankments can check soil erosion by preventing flood water to flow out. With the help of the chart show them that stone walls along river banks (embankments) also check floods during rains. Thus it helps conserving soil. This also checks the damage caused by running water.

Chart showing river banks/stone wall

Activity 5

Recognise the advantages of terracing of slopes

Ask students to take some mud and make two mud-hills on the floor. Cut one hill stepwise. This is called terracing. Sow *rye* seeds on the steps of this hill. Water it regularly for two days. After a few days *rye* seedlings will sprout. Now pour water on both the hills with equal pressure.

Mud, *rye* seeds, water, beaker

What do you observe?

Help them to observe that water causes soil erosion on the hill which does not have terraces and plants. On the other hand water passes down slowly on the hill which has terraces. Terracing is done in hilly areas to conserve the soil.

Chart/picture showing terraced cultivation

If there are examples of terrace-farming land nearby, take the students to see it. Otherwise show them pictures of terracing carried out to prevent soil erosion.

Terracing of field prevents soil erosion

Recognise the advantages of making furrows for soil conservation

Activity 6

Mud, *rye* seeds, water, beaker
Chart showing furrowed fields

Ask students to make a mud-hill and to make drains (furrows) on it with their fingers. Sow some *rye* seeds all over the hill bearing drains (furrows). When seedlings sprout, pour water all over the hill.

What do you observe?

Help them to infer that maximum water passes down through drains (furrows) and thus soil is conserved on rest of the hill.

Furrowed fields

Identify the steps to prevent soil erosion in the surroundings

Activity 7

There are several steps to prevent soil erosion in the surroundings.

1. Ask students to draw posters and write slogans on:
   — Avoid cutting down trees.
   — Do not allow cattles and other animals to destroy plants by overgrazing as they erode the soil too.
   — Keep off the grass.
   Make such sign boards and put them wherever a lawn is maintained in your surroudings.

2. Encourage the activity of planting trees and other suitable plants in your locality.
3. Grow plants which require less water along the roads and at places where rainfall is low, to prevent the advancing of desert conditions.
4. In case there is improper drainage of rain-water in your locality, do inform the local authorities.
5. Educate people about the ill effects of overgrazing by domestic cattle and the cutting down of green plants and trees.

E 1

Organise debates and competitions on topics like soil conservation, *Vana Mahotsava* to encourage the students to appreciate the importance of soil conservation and the harmful effects of soil erosion.

UNIT 4: AIR AND ITS USEFULNESS

(Air-its uses and its pollution)

Introduction

The students are familiar with the properties of air around them. They also know the process of breathing and the importance of oxygen which is present in air.

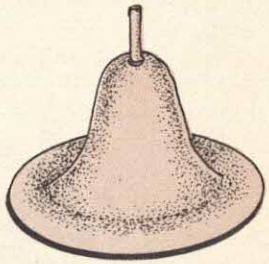
In this Unit, the students will be able to

- state the properties of air,
- state the names of gases present in the air and identify their uses,
- distinguish between the fresh (unpolluted) and polluted air,
- recognise the need for fresh air.

4.1: How do we know that air exerts pressure?

Focus on: Pressure exerted by air

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise that air exerts pressure	**Activity 1** Provide a rubber sucker to a student and ask him/her to press it against the hard smooth surface of a table. Now ask him/her to pull it upwards. Let the whole class observe. Ask other students to repeat the above activity. What do you feel when you pull the rubber sucker upwards? Why is it difficult to pull it upwards? Help the students to infer that as we press the rubber sucker, the air inside it is pushed out, making air pressure inside it less. Thus there is excess pressure exerted by air on the outer surface of rubber sucker as compared to air pressure inside it. This makes pulling up of the rubber sucker difficult. Ask them to repeat the activity by pressing the rubber sucker against the bottom of a decimetre cube vessel containing a little water and then pulling it upwards. Ask the students: What do you observe when the rubber sucker is pressed? (Air bubbles coming out in water) What happens when the rubber sucker is pulled upwards?	Rubber sucker, decimetre cube vessel, water  Rubber sucker
	Activity 2 Ask a student to take an empty tumbler and keep it close to his/her mouth, i.e. cover his/her mouth with the tumbler. Let him/her suck the air and then hold his/her breath. Ask him/her to take away his/her hand from the tumbler. Ask other students to repeat this activity.	Tumbler

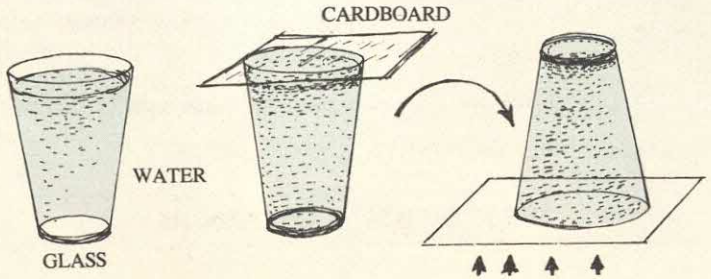
Ask:
Does the tumbler fall down from the mouth?
Why does it not fall down?

Help the students to understand that the air pressure inside the tumbler is reduced by sucking air. The pressure of air outside does not change and this being greater than the pressure inside, prevents the tumbler from falling down.

Activity 3

Glass tumbler, thick paper/cardboard, water

Ask a student to take glass tumbler, fill it completely with water and put a thick paper/card board on its mouth.
Ask him/her to hold the thick paper with the help of his/her palm and gently turn the glass upside down.
Ask him/her to take away his/her palm from the mouth of the glass tumbler.
Let other students also repeat the above activity.
Ask:
What do you observe?
Why does the water not fall down from the glass?
Help the students to infer that the excess pressure exerted by air on the thick paper prevents water from falling down.



Air exerts pressure

4.2: How do we use air in inflating things like balloons and also in moving liquids?
Focus on: Use of air in inflating and for moving liquids

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify that air has the property of inflating things	**Activity 1** Ask the students to take some balloons and blow air into them. Ask: What do you observe ? (Balloons get inflated) What are the other things which are inflated by air ? Help them to infer that air is used to inflate balloons, football bladder, air pillow, and tubes of cycles, scooters, trucks and cars. Ask a student to go on blowing air into a balloon till it bursts. Ask: Why does the balloon burst ? (Due to excess pressure of the air inside the balloon) Help the students to infer that excess pressure of air should be avoided while inflating balloons, and the tubes of cycles and scooters.	Balloons
Recognise that air pressure can move liquids	**Activity 2** Ask a student to take a glass tumbler/beaker. Fill it with water, coloured by adding a few crystals of potassium permanganate. Put a straw or a glass tube in water. Ask him/her to suck air through the straw or the glass tube. Ask: What happens when you suck air ? Why does water rise in the straw or glass tube ? Help the students to infer that by sucking air through the straw or the glass tube, the pressure of air inside it is reduced. The excess pressure exerted by air on water pushes it up and therefore water rises in the straw.	Water, straw glass tube, glass tumbler/beaker, potassium permanganate

Ask another student to suck water through the straw/glass tube, close its upper end with his/her finger and take out the straw/glass tube from the water.

Ask:

What do you observe? (The water remains in the straw)

Now ask the student to release the pressure of the finger slightly.

What happens now? (Water drops out)

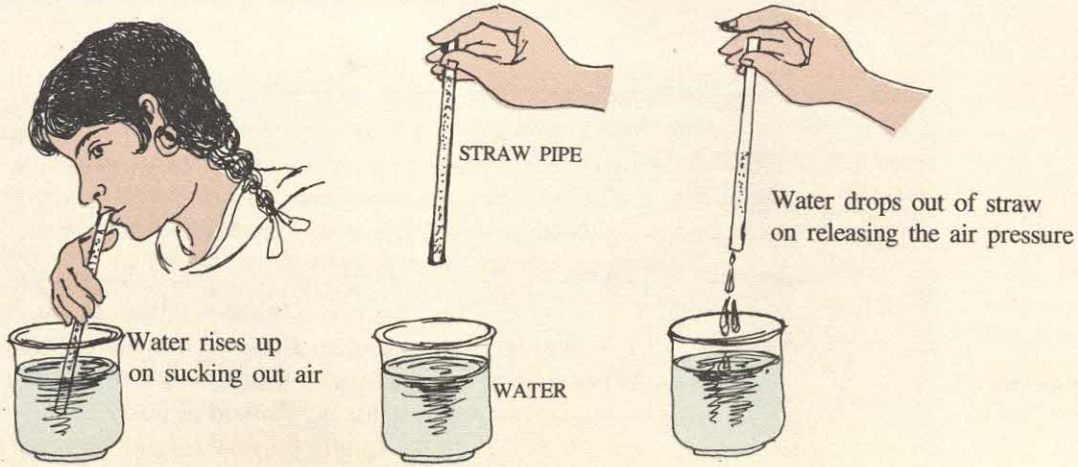
Now ask him/her to remove the finger from the upper end the straw completely.

Ask:

What happens when the upper end of the straw is left open? (Water drops out completely)

Why does water drop out completely?

Encourage the students to infer that on releasing the pressure of the finger slightly, air rushes into the straw and water drops come out due to slight increase of air pressure inside the straw. When the upper end of the straw is left open, more air rushes in and water in the straw drops out completely. Thus air pressure causes the liquid to move down. Elicit from the students other examples from daily life situations where this property of air is used.



Air pressure moves the liquid

E 1

Hammer, nail, tin box, water, can

Ask a student to perform the following activity:

Take a tin box (powder tin or any other tin box) closed at the both ends.

Make 8 to 10 small holes at the bottom and one hole in the lid or at the top.

Dip the tin box in water kept in a can.

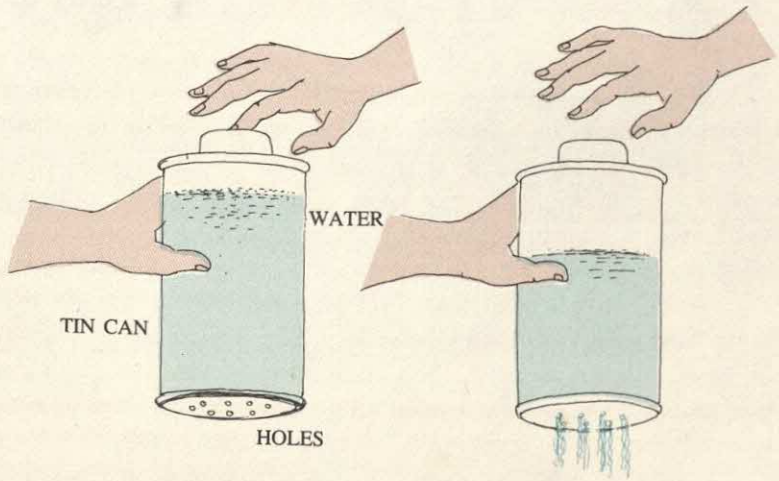
Close the upper hole with your finger and take out the tin box from water.

Ask the student to remove his/her finger from the upper hole for a very short time and close it again. Let other students repeat this activity two or three times and then ask:

What happens when the upper hole is kept open by removing the finger for a short time?

What happens when the upper hole is closed again by the finger?

Why does water come out of the bottom holes, when the upper hole is kept open?



Help them to infer that water comes out of the bottom hole upon opening the upper hole due to the pressure of air. Recall the experience of students about the tea kettle. Draw their attention to the fact that unless there is a hole or an opening in its lid, tea cannot be conveniently poured into another pot.

4.3: What are the gases present in the air and in what ways are they important to us?

Focus on: The different gases present in air and their uses (2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify the gases present in the air

Activity 1

Recall the previous knowledge of the students about air with the help of the following questions:

Which gas is absorbed by blood when one breathes in? (Oxygen)

Which gas is more in the exhaled air as compared to the inhaled air? (Carbondioxide)

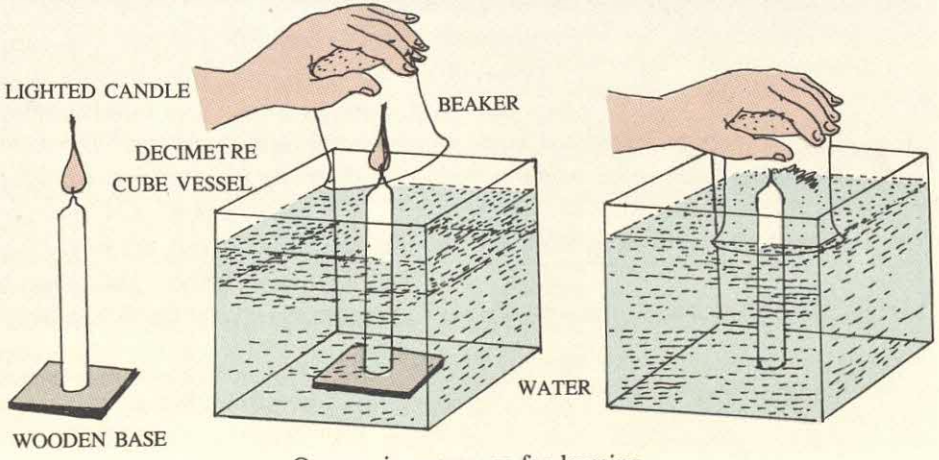
What are the gases present in air?

(Oxygen, carbondioxide, nitrogen, some other gases and water vapour)

Decimetre cube vessel, two candles, beaker/glass tumbler, match box

Recognise that oxygen is used up in burning

Ask students to fix a lighted candle on a wooden piece and keep it in a decimetre cube vessel as shown in the figure. Pour some water in it. Invert a beaker over the candle keeping the mouth of the beaker under water.



Oxygen is necessary for burning

Let another student light another candle and place it nearby.

Let the whole class observe as to what happens to the two burning candles.

Ask:

What do you observe? (The candle covered by the beaker gets extinguished whereas the other candle keeps on burning)

Why does the burning candle extinguish after some time? (Due to cut-off of air)

What do you infer?

Help them to infer that the component of air is active which helps in burning. When it is used up, the candle stops burning. This active component of air is called oxygen.

What happens to the level of water after some time?

(The level of water rises inside the glass/beaker)

Why does the level of water rise after sometime?

Identify that carbon dioxide dissolves in water and water takes up its place

Explain that the oxygen is used in burning, giving out carbon dioxide which dissolves in water and makes the water rise.

Activity 2

Recognise the presence of carbon dioxide in air

Lime, spoon, water, two glass tumblers/two beakers

Ask a student to:

—take 2 spoon-ful of lime in a glass tumbler/beaker.

—fill the glass about two-third with water.

—stir with a spoon and allow the contents to settle.

—decant the clear liquid to another beaker. (This clear solution is lime water).

—keep the lime water in open air.

—observe the lime water next day.

Ask students the following questions:

What happens to the lime water when it is kept in open air for a long time?

(Lime water turns milky)

Why does lime water turn milky?

Help the students to infer that carbon dioxide is present in the air. It turns lime water milky.

State the uses of oxygen, nitrogen and carbon dioxide

Activity 3

Recall the experiences of the students and ask the following questions:

What is the use of oxygen in daily life?

(Used in burning and respiration)

Help the students to infer that oxygen is used by divers and mountaineers. It is also used by patients.

What gas do the plants use from the atmosphere during the day? (Carbon dioxide)

What are the other uses of carbondioxide?

Make the students aware that carbondioxide is used in preparing aerated drinks (soda water). It is also used for extinguishing fire.

What is the use of nitrogen?

Make the students aware that nitrogen is used in manufacturing fertilisers.

What are fertilisers?

(Fertilisers are some chemical substances that help in better growth and development of plants)

Urea, ammonium sulphate

Give examples of fertilisers.

(Urea, ammonium sulphate, etc)

Note: Show the samples of urea and ammonium sulphate.

4.4: How do we distinguish between fresh and polluted air?

Focus on: The extent of the freshness of air

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Distinguish between fresh and polluted air

Activity 1

Recall the experiences of the students by asking the following questions:

How do you feel when the surroundings become full of smoke produced by burning

cow dung, coal or fire wood, or industry?
(Feeling of suffocation and irritation)
What causes suffocation?
How do you feel in an open park or a field in the morning?
(Feeling of freshness)
What causes freshness?

Make the students aware that air becomes polluted due to the presence of smoke which causes irritation and suffocation. In an open park or a field, air is free from pollution and therefore there is a feeling of freshness.

Identify the factors that cause pollution of air

What are the other factors responsible for the pollution of air? (Dust particles)

Make the students aware through discussion that the smoke/gases given out by the chimneys of factories, steam engines, petrol or diesel car/truck engines pollute the air. Gases given out during the decay of plants and animals also cause pollution.

4.5: How do we recognise that polluted air is harmful to us and fresh air is essential for good health?

Focus on: Air and health

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify the harmful effects of pollution

Activity 1

Recall the experiences of students regarding harmful effects of pollution and the need for fresh air.

Ask:

How do you feel when you stay for some time in a smoky atmosphere? (Feeling of suffocation, and watering of eyes take place)

What happens when you stand near dead and decaying waste matter?
(Feel like vomitting)
Why do you feel so? (Due to foul smell)
What is the effect of the decaying of dead animals and plants on air? (Air gets polluted)
What kind of air is essential for maintaining good health?
Make students aware that fresh air is essential for good health and polluted air is very harmful.

Recognise that fresh air is needed for good health

What are the diseases caused by pollution of air?
(Diseases like asthma, bronchitis)
What is the effect of pollution of air on plants and crops?
(Plants and crops are damaged)

E 1

What are the other effects of pollution of air?

Recall what happended in Bhopal a few years ago. The leakage of gas from the carbide gas plant polluted the air to such an extent that hundreds and thousands of men, women and children lost their lives. Even today the victims are suffering from eye troubles. Deformed babies have been born due to the above tragedy.

Make the students aware that even non-living things are not spared by pollution. Cite instances of historical buildings and monuments which are being corroded and defaced due to increased industrial activities resulting in pollution.

E 2

In what ways do you protect yourself from polluted air?

Make the students aware that proper ventilation, if provided in houses, facilitates movement of fresh air. Windows when kept open also provide fresh air. Thus the effects of polluted air are minimised.

Make it clear that a burning *angithi* should never be kept in a closed room because it greatly pollutes the air.

UNIT 5: FORCE, WORK AND ENERGY

(Force, work and energy; Simple machines)

Introduction

The students have learnt about force and energy in class IV. They are also familiar with different sources of energy. They have also learnt how energy can be converted from one form to another.

In this Unit, the students will be able to

- identify the effects of applying force on different objects,
- state the different ways in which force is exerted and their role in doing work,
- identify the different types of simple machines used in daily life to do work,
- identify the reasons for conserving energy and to take steps for proper use of energy.

5.1: What are the effects of applying force on different objects?

Focus on: Force causes motion

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the effects of applying force on different objects Identify the effects of applying force on a body in motion	Activity 1 Ask a student to push or pull a table, duster and a stone tied with thread. What happens to the table, duster or the stone? Infer that a push or pull can move a body at rest. Ask one of the students to pull a table and another student to push it in the same direction. What do you observe? Why does it move faster?	Table, duster, stone, thread

Recognise that force can slow down a moving body or change its direction

Football

Activity 2

Ask two students to stand at some distance, facing each other. Let one student roll a football gently on the floor/ground towards the other student. While the football is moving ask the other student to apply force on the rolling football from the opposite direction. While it is moving let him/her kick the football in any other direction.

Ask the students:
What happens to the rolling football when the force is applied in the opposite direction?
Does the football move along the same direction after it is kicked?
Why did the direction change?

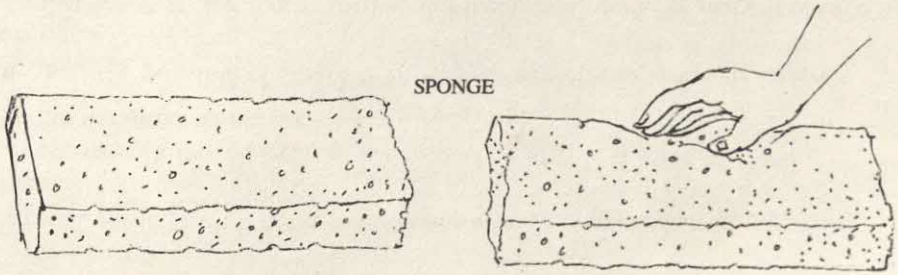
Why does the direction of smoke from an *agarbatti* change when air is gently blown on it?
Help them to infer that force can slow down a moving body or make it change its direction.

5.2: What happens when force is applied on soft objects?

Focus on: Force can deform soft objects

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the effects of applying force on soft objects	**Activity 1** Provide the students with some kneaded flour, clay or plasticine in the form of a ball and let them press it. Ask them: What happens to the shape of the ball of clay/kneaded flour or plasticine when they are pressed? Why are soft objects deformed? (The force applied on soft bodies deforms them)	Kneaded flour, clay or plasticine, balloon



Force can deform soft bodies

Activity 2

Provide a student with a big balloon and ask him/her to inflate it a little, and then ask him/her to press it with his/her hand.
What happens when the balloon is pressed?

Balloon

Cite other examples of wet cotton/sponge and rubber. Make the students realise that some objects get deformed on application of force.

Ask the students to give examples from daily life where this property of force working on soft objects can be utilised to our advantage.

(Tooth paste tube being squeezed; making *chapati*, mashing of potatoes, etc)

Cotton, sponge

Clay models

5.3: What are the different ways of exerting force?

Focus on: Muscular force and stored energy

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise that muscular force helps in pushing or pulling objects	Activity 1 Through discussion, draw the attention of the students towards their daily life experience, where in the force is exerted on bodies in different ways.	Swing, bucket, rope, ball

Ask them:

What type of force do you apply when:
—you push a boy sitting on a swing,
—you play a game of tug of war,
—you draw water from a well,
—animals pull carts.
Help them to infer that all these instances involve muscular force.

A woman drawing water from the well

Identify that stored energy exerts force when released

Activity 2

Spring toy, rubber band

Give one student a spring toy which has a winding mechanism with a spring and key. If possible, show to the students the spring as it is being wound.

Ask the student to wind the spring of the toy with the help of its key and release it.

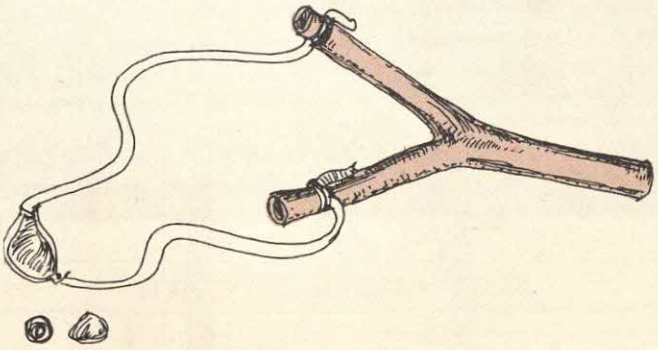
Ask them:
Why did you wind the spring of the toy?
What happened when you released it?
(The toy moved forward)
Why did this happen?

Help them to infer that some energy is stored in the spring when it is wound. The stored energy helped it to exert force when released and made the toy move forward.

Ask students to make a comparison of this activity with the stretching and releasing of a rubber band.

E 1

Help them to understand the working of catapult in which the energy stored by pulling the rubber backward is used for throwing the stone forward far away.

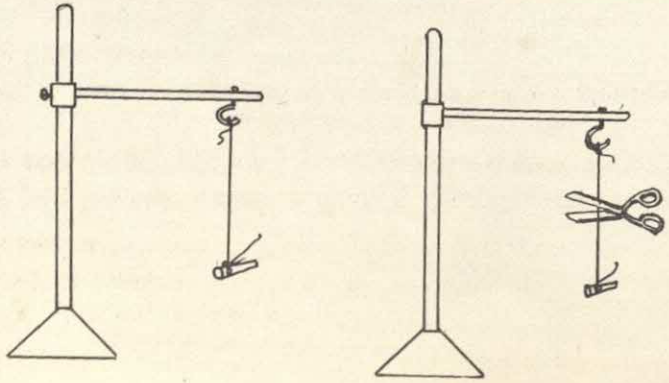


5.4: How is the force exerted by gravity?

Focus on: Force of gravity

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
State that all bodies when dropped fall on the EARTH due to gravity	Activity 1 Ask a student to drop a stone from his/her hand. What do you observe? Where did the stone fall? Activity 2 Ask another student to tie a piece of chalk with a string. Let him/her hold one end of the string in the hand and cut the string. What do you observe? Where did the chalk-piece fall?	Stone Piece of chalk, string



Help the students to infer that in both the cases the stone and the piece of chalk fell on the ground (EARTH) as if something is pulling them down to the EARTH. This pull of the EARTH is a force called the force of gravity.

Ask the following questions from their daily life situations.
Why do leaves of plants/trees fall down on the EARTH?

Why do the rain drops fall down?

Help students to conclude that the force exerted by the EARTH on all objects is called the force of gravity. The force exerted by bodies on each other is called gravitational force.

E 1

Narrate the story of the great scientist Newton who discovered the law of gravitation.

Story

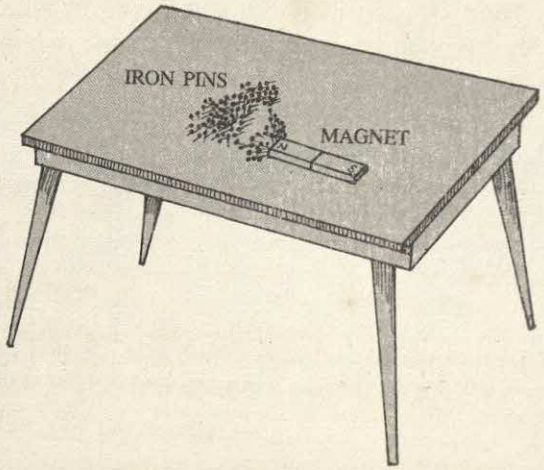
One day Newton was sitting under an apple tree in a garden. He saw an apple falling down from the tree. A thought came to his mind that there should be some reason behind falling of the apple on the ground and not going upwards. So he came to a conclusion that there is a force exerted by the EARTH which pulls (attracts) all the objects down. He named this force as the force of gravity.

5.5: How is force exerted by a magnet?

Focus on: Magnetic force

(1 Period)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the magnetic force	Activity 1 Ask a student to spread some iron nails/alpins on the table and ask him/her to take a magnet near the nails/pins. Let him/her also take a piece of iron/iron nail near the magnet.	Iron nails/pins, magnet



Magnet attracts iron objects

Ask:

What do you observe?
(The magnet pulls them towards it)

Why do the iron nails/pins stick to the magnet?
(The magnet attracts iron so the iron nails/pins stick to the magnet)

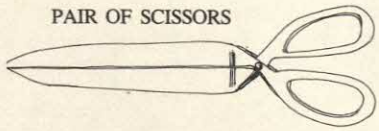
Can a piece of iron be made to attract a magnet?
How?
Explain to them that the force exerted by a magnet is called magnetic force.

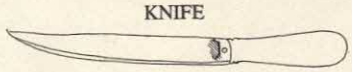
5.6: How can work be made easier with the help of simple machines?

Focus on: Simple machines make work easier

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the different types of simple machines used in daily life to do work	Activity 1 Through discussion draw the attention of students to different objects which they use in their daily life to make any work easier.	Knife, blade, a pair of scissors





Ask them:
Name the objects (tools) used for cutting vegetables.
Name the objects (tools) used to cut a piece of cloth.
Name the tool used for sharpening a pencil.
Name the object used for cutting wood.
What do you use to pick up a piece of burning coal?
What does a labourer use to dig up the earth?

Activity 2

Identify that simple machines make work easier

Call two students and ask them to cut an apple/potato into four equal pieces. Ask one student to cut it with a knife and the other to cut it without using a knife.

Apple or potato, knife

Who is able to cut the apple/potato into four equal pieces?

(The student cutting it with a knife)

Why is he able to cut the apple or potato?
(He is able to cut the apple or potato because he is using a knife)
Ask the student to cut the apple or potato with a wooden or plastic scale.
Which of the two-the knife or the scale, is able to cut the apple more easily and faster? (Knife)

Activity 3

Draw the attention of students to their daily life experiences. Students must have seen a well where water is drawn directly from it with the help of a rope only; and also where the rope passes over a pulley (wheel with a grooved rim).

Which way of drawing water is easier?
Why is it easier to draw water from the well when the rope passes over a pulley?
(The pulley makes it easier to draw water from the well)
Help the students to infer that things like knife or a pulley that make our work easier and faster are called simple machines.

Activity 4

Show students pictures of daily-life situations where tools and simple machines are used.

Pictures of daily life situations using simple machines

Ask them:

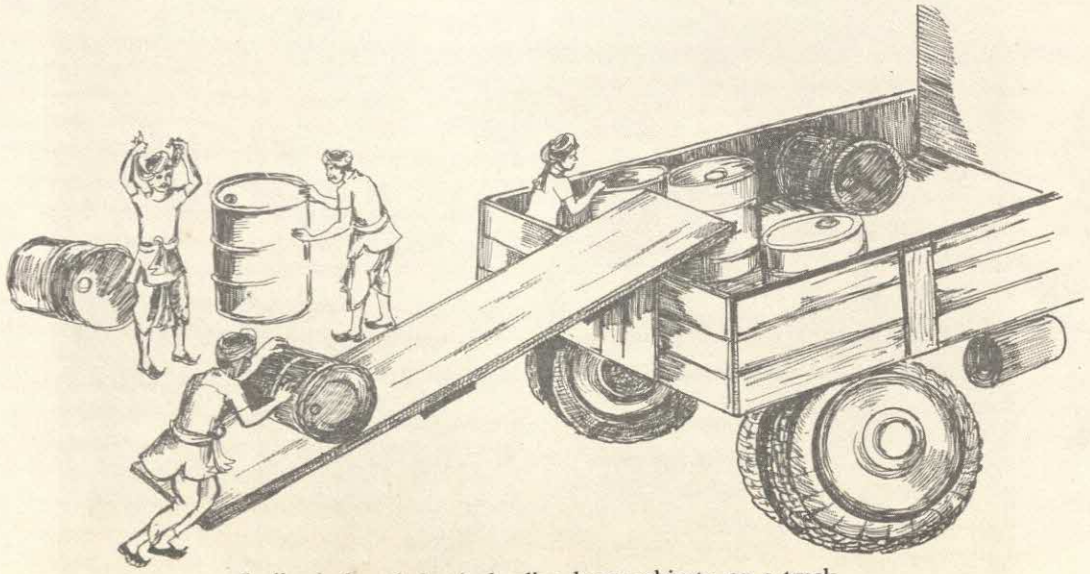
When a heavy object (barrel) is loaded/unloaded on a lorry, van, cart or a truck, which of the two ways shown in the figure is easier and more convenient?

a) lifting the object directly, or

b) sliding or rolling the heavy object (barrel) along a sloped wooden plank kept in an inclinded position.

(Sliding the barrel along an inclined or sloped wooden plank)

Tell them that a plank used in this way is called an inclined plane which helps us in lifting the heavy objects easily.



Inclined plane helps in loading heavy objects on a truck

Help them to infer that the simple machines make our work easier and faster. With the help of simple machines (the inclined plank, knife, etc.) we can do more work by applying less force. Machine (the pulley) can change the direction of the application of the force and makes our work more convenient.

E 1

Ask students to make a list of all the activities they observe in and around their home where they use their hands only and also where the work is done with the help of some other devices.

Activity	Using hands only	Using some other devices
Cutting of vegetables	—	Knife
— —		
— —		

5.7: What are levers?

Focus on: Levers as simple machines

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify lever as a simple machine	Activity 1 Ask students to take a can with lid. Tightly close the lid of the can and then ask a student to take out the lid using only his/her fingers. Is it easy to take out the lid? Now let him/her try to take out the lid with the help of a strong metallic spoon/screw driver. What difference do you feel?	Can with a lid, metallic spoon/ screw driver

Why is it easier to take out the lid with a spoon?
Help students to infer that the spoon makes our work easier, acts as a lever which is a simple machine.

Activity 2

Ask two students to dig a small pit in the earth. Provide a small shovel/*khurpi*, to one student and ask the other student to dig the earth with his/her hands only.

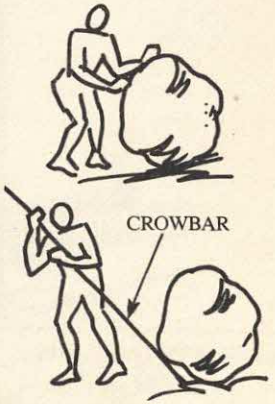
Khurpi/shovel

Who is able to dig easily?
Who is able to dig faster?
Why does the student having shovel/*khurpi* dig faster?
(Because the student is using a *khurpi* which acts as a simple machine)

Activity 3

Ask a student to lift or move a heavy stone from the ground with his/her hands only. Then ask the same student to move the stone with the help of a rod (crowbar) by putting the rod under the stone as shown in the figure.

Heavy stone, crowbar/rod



Which of the two ways of moving the stone is easier?

Why were you able to move the stone easily with the help of a rod?

(Because the rod was acting as a lever which is a simple machine)

Activity 4

Ask students to take a very small object which cannot be easily picked up by hand. Provide a number of tools like a pair of tongs, screw driver, a pair of scissors, tweezer, etc.

Which of these tools can be used to pick up the small object?

Help students to infer that the tweezer acts as a lever which is a simple machine.

Also tell that all these tools act as a lever and are simple machines.

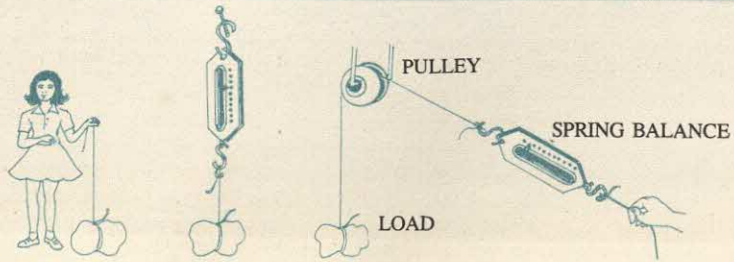
Small object, pair of tongs, screw driver, pair of scissors, tweezer

5. 8: What are pulleys?

Focus on: Pulleys as simple machines

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify that pulleys are simple machines	Activity 1 Through discussion make students recall that drawing water from a well by pulling a rope over a wheel-like device (pulley) is easier and more convenient. Ask students to cite more examples where a rope/string passes over a wheel to make the work simpler. Tie a stone with a string. Ask a student to lift the stone by holding the free end of the string. Let him/her tie the free end of the string to the hook of the spring balance, gently holding its other hook in the hand as shown in the figure and note its reading. Fix a pulley on the stand and pass the string over the pulley as shown in the figure. Again pull the stone gently through the spring balance and note its reading. Ask them: What is the difference between the readings in the two cases? (No difference is expected in the readings which implies that the same force is needed in both cases) Is it more convenient to lift a stone through a pulley?	Pulley, spring balance, thread/string, stone



Pulleys make the work easier

(A pulley is a simple machine which has a wheel with a groove on its rim. When the string or rope passes over the groove, it helps to lift heavy objects easily, by changing the direction of the force applied)

E 1

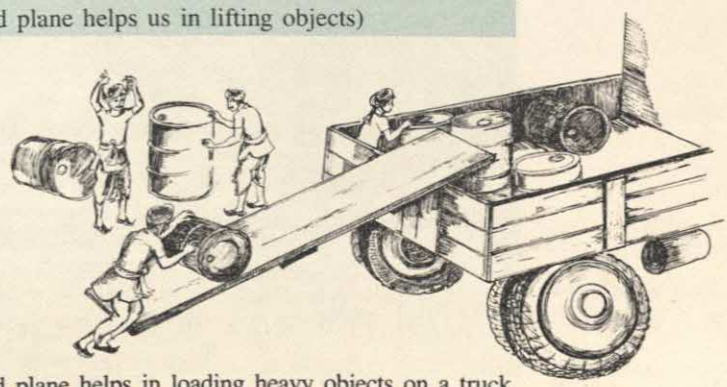
Organise a field trip and show the use of pulley in lifting heavy weights with the help of a crane. Flag pole, *chik* curtains, lift, etc., offer other examples of the use of the pulley.

5. 9: How does an inclined plane help in lifting?

Focus on: The inclined plane as a simple machine

(1 Period)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify that an inclined plane acts as simple machine	Activity 1 Draw the diagram on the board and ask the students: Will the man find it easier to lift a barrel into the van or to roll it along a sloped wooden plank? (Sloped wooden plank as an inclined plane helps us in lifting objects)	



Inclined plane helps in loading heavy objects on a truck

Activity 2

Take the inclined plane and arrange the activity as shown in the figure.

Inclined plane, spring balance, wooden block, thread/string

Ask the students to

— tie one end of the string to a spring balance and the other end to a wooden block.

— suspend the wooden block and note the reading of the spring balance.

— place the wooden block on the inclined plane and pull it gently till it moves and note the reading.

Ask them:

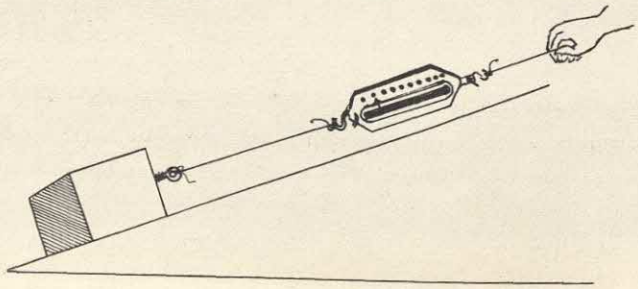
What is the difference in readings of the spring balance in both the cases?

In which case is the reading of the spring balance less?

Why is the reading less in the second case?

(Reading is less in the second case because less force is required since the block is sliding over the inclined plane)

Ask students to cite more examples wherein an inclined plane is used. (Children slide, stairs, ladder, wooden planks used at construction site, roads on the hilly area, slope, ramps)



Inclined plane makes the work easier

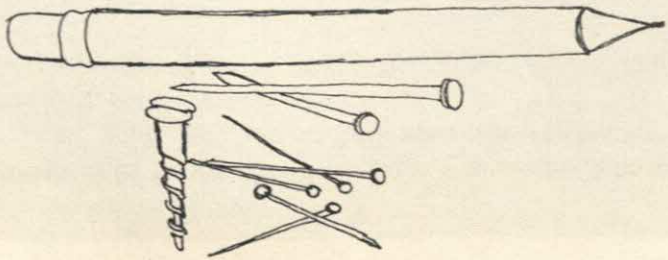
Help students to infer that the inclined plane is a simple machine, which enables us to lift heavy loads with less force. A slope is also called an inclined plane.

5.10: How is wedge useful to us as a simple machine?

Focus on: Knife as a simple machine

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify wedge as a simple machine	Activity 1 Draw the attention of the students towards the blade of an axe, a chisel, a knife, etc. What is the difference between the two edges of each of these tools? (One edge is sharper than the other) Provide a student with a knife and ask him/her to cut a potato using its sharp side and then using the blunt side. With which side was it easier to cut the potato? (Cutting with the help of the sharp edge of the knife is easier) Explain to them that the wedge is a simple machine having two edges, one being sharp and the other blunt. Force is applied on the blunt edge and the sharp edge is kept on the object, which is to be cut. Pencil tips, nails, alpins are some example of a wedge.	Potato, knife



Activity 2

Draw the attention of the students towards the shape of (preferably by showing) some objects like nail cutter, screw, nail, hammer, bottle opener, nut cracker, forceps, top of a flag pole, pencil tip, nib of a pen, etc.

Ask them to identify these objects as lever, pulley, inclined plane or wedge and fill in the table.

(The table has been filled in for your information)

Object	Type of machine
Blades of a nail cutter	Lever
Thread of a screw	Inclined plane/wedge
Nail	Wedge
Hammer	Lever
Bottle opener	Lever
Nut cracker	Lever
Forceps	Lever
Top of a flag pole	Pulley
Pencil tip	Wedge
Nib of a pen	Wedge

5.11: Is energy required for doing work?

Focus on: Energy as the capacity to do work

(1 Period)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the reasons for conserving energy and to take steps to prevent the improper use of energy	Activity 1 Draw the attention of the students towards the various activities they perform every day. Ask them: Why do you eat food? Why do people get petrol filled in their vehicles? What happens to an electric fan when it is switched on? Why do you feel tired after doing some exercise? (When you are tired, you have less energy. It is reduced because you did some work for doing the exercise for which you use some energy) Help them to infer that for performing all the activities, energy is required. Energy is the capacity to do work. If there is no energy, no work can be done.	

5.12: Are sources of energy limited?

Focus on: Different sources of energy

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Recognise that sources of energy are limited

Activity 1

Draw the attention of the students towards their daily life experience regarding various sources that provide energy.

Ask them:

What are various sources of energy? (Coal, petroleum, wind, wood, SUN, water, biomass, etc)

Which sources of energy are likely to remain forever?

(SUN, moving air, running water)

Name the sources of energy which will be exhausted after some time.
(Coal, petroleum)

Recognise the importance of energy

Activity 2

Draw the attention of students towards widespread use and also quick depletion of coal and petroleum.

Ask students:

Why is it essential to conserve energy?
Help them to conclude that certain things which are sources of energy, if they are used continually at the present rate, will soon be exhausted.

Ask:

What would happen to the ink in a pen, lead of a pencil or wax of a burning candle, water in a tank, if they are used continuously?

(Ink, lead, candle, wax and water will be exhausted rather quickly after sometime)
Correlate these with the use of coal and petroleum.
Explain that in the same way if they are used continuously, they will soon be exhausted.

Draw the attention of the students to the extensive uses of coal and petroleum.

(For example, generation of heat and electricity, drugs, dyes, plastics, pesticides, fertilisers, fabric, etc)
Help them to infer that with the continual use of certain sources of energy, they will soon be exhausted. There is an imperative need to save and conserve certain sources of energy and also use alternative sources of energy.

5.13: How is energy conserved?

Fucus on: Conservation of energy

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify the ways in which energy can be conserved

Activity 1

Draw the attention of students towards daily life situations where energy is properly utilised.

When coal or wood is used as fuel, then do we use it completely?

On a bright sunny day, you draw the curtains of your room and switch on the light. Are you doing the right thing?

Ask the students to cite more examples where energy is not properly utilised.

Activity 2

Start off a discussion and ask students as to how we could make proper use of energy i.e. how the energy can be conserved.

Ask them:

How will you conserve electric energy?
(Switches of the electrical equipment should be put off whenever they are not in use)

What can be the alternatives of coal, kerosene and wood? (Solar energy or bio-gas should be used for cooking, instead of coal, kerosene or wood)

What precautions will you take while cooking, to save heat energy?

(While cooking, the cooking vessel should be covered with a lid. Pressure cooker should be preferred to ordinary utensils. Bottom of the utensils should be blackened. Vegetables should be chopped before lighting the fire. While the food is cooked, all the family members should eat the cooked food at the same time, to avoid reheating of food)

What precautions should be taken while using different machines/vehicles?

(Ignition switch of the vehicles should be put off at the red lights signal on traffic crossings, machinery of vehicles or the machines in a factory should be oiled for smooth working)
Make students appreciate the fact that energy should be conserved.

UNIT 6: THE EARTH AND THE SKY
(Shadows)

Introduction

The students know the idea of transparent and opaque objects. They are also aware that when they stand in the sunlight during the day or in tube light or bulb light at night, shadows are formed. They are also aware of the phases of the MOON, and natural and also artificial satellites. In this Unit, the students will be able to

- distinguish between transparent, translucent and opaque objects,
- recognise that shadows are caused by obstruction of the light by opaque objects,
- see relationship between shadow formation and size of the object,
- see relationship between size of the shadow and distance of the opaque object from the source of light,
- see relationship between shadow formation and occurrence of eclipse,

— identify the causes of solar eclipse,
— identify the causes of lunar eclipse,
— distinguish between solar and lunar eclipses,
— generalise that solar and lunar eclipses occur on the new-moon day and full-moon day, respectively.

6. 1: What are transparent, translucent and opaque objects?

Focus on: Transmission of light and formation of shadow

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Classify objects as transparent, translucent, and opaque	Activity 1 Recall the students' experiences about objects through which light can pass and through which light cannot pass. Ask them: Name a few objects through which light can pass. Name a few objects through which light cannot pass. Activity 2 Light a candle and ask a student to hold a glass slide/sheet in front of it. Ask him/her to view the candle flame, from other side of the glass slide/sheet and ask: What do you observe? Now put a kite paper/or a paper rubbed with oil, in front of the candle flame and ask students to view the flame, from the other side of the kite paper/paper rubbed with oil. What do you observe now? What is the difference between the visibility of the flame in the two cases? Help them to infer that the candle flame was very clearly visible through glass	Candle, matchbox, kite paper/oiled paper, glass slide/sheet, wooden block

sheet/slide and it was not very clearly visible through the kite paper/paper rubbed with oil.

Help them to infer that the material of the object through which light can be seen clearly is called transparent and that through which light can be only partially seen is called translucent.

Ask them to put a wooden block in front of the flame and observe.

Ask:

What do you observe now?

Help them to infer that the flame is not visible through the wooden block. The material of the object through which light cannot be seen is called opaque.

E 1

Ask the students to collect a few materials from the surroundings and put the information about them in the table.

Material	Transparent	Translucent	Opaque
Glass sheet	✓	×	×
Kite paper	×	✓	×
Wooden block	×	×	✓
Notebook paper			
Ground glass			
Oiled paper			
Onion skin			

Recognise that shadows are formed when light is obstructed by opaque objects

Activity 3

Recall the students' observation if the lighted candle could be visible through the glass slide, kite paper or the wooden block with reference to the activity 6.1.2. Ask them to try with the previous activity to observe if the shadow is formed on the

Candle, matchbox, glass slide/sheet, kite paper, wooden block

wall by any of these objects.

What do you observe on the wall when the glàss slide/sheet is placed near the flame?

What do you observe on the wall when the kite paper is placed near the flame?

What do you observe on the wall when the wooden block is placed between the wall and the flame?

What difference do you observe between the above three cases?

Help them to infer that shadows are formed when light is obstructed by objects. An opaque object casts a dark shadow in the presence of light, a translucent object a weak one and a transparent object does not cast any shadow at all. Tell them that shadows are clearly visible on a screen which may be any wall, ceiling, ground, etc.,

An opaque object, source of light and screen are the three requirements for shadow formation.

Activity 4

Hold a lighted candle in front of a torch and ask the students to observe.

Candle, torch, matchbox

Is there any shadow of the flame of the candle on the screen or wall? (No)

Help them to infer that only opaque objects form the shadow. If the body is itself a source of light (luminous), no shadow will be formed.

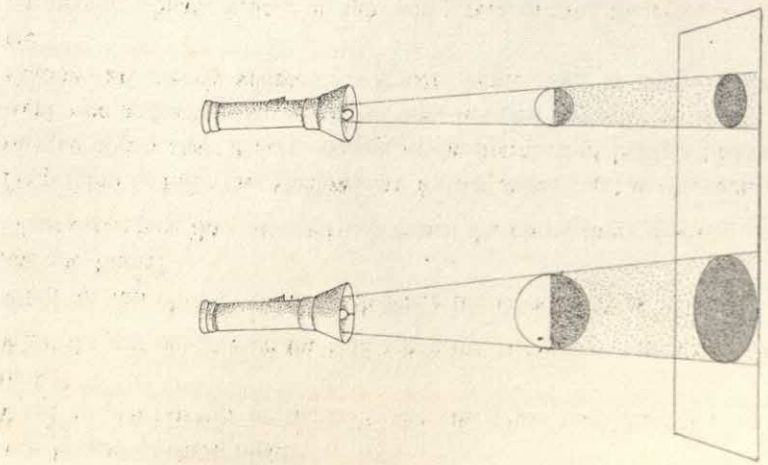
Note: The EARTH, the MOON and the planets also cast their shadows by blocking the light coming from the SUN.

6. 2: What are the factors affecting shadow formation?

Focus on: The factors affecting shadow formation

(2-3 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise the relationship between size of the shadow and size of an object	Activity 1 Fix a lighted candle/torch and ask the students to observe the shadow formed, on the screen/wall, first by holding the smal ball and then the bigger ball in front of it at the same distance from the torch/candle. Ask them: Which shadow is bigger in size? Which shadow is smaller in size? Infer that the size of the shadow increases with the size of the object.	Candle/ torch, match box, big ball, small ball, screen



Size of the shadow increases with the size of the object

Recognise the relationship between the size of the shadow and the distance of the opaque object from the source of light

Activity 2

Torch/ candle,match box, ball, screen

Fix a lighted candle/torch and ask a student to hold a ball in front of it. Assuming the wall in the room to be a screen, ask the students:

What do you see on the wall?

Why is the shadow formed?

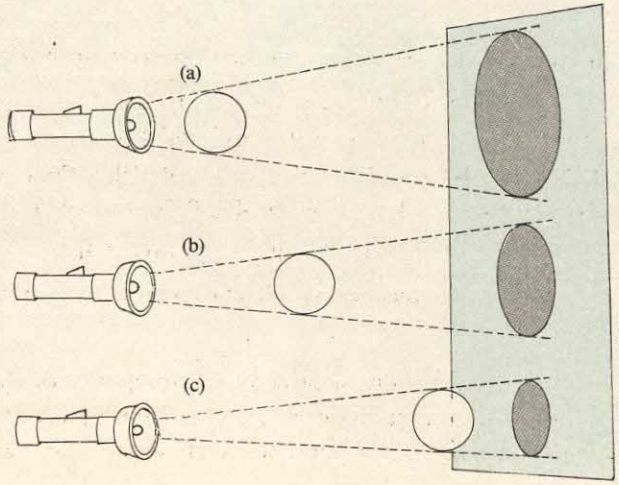
Ask students to put the ball near the source of light as shown in figure (a) and observe the size of the shadow falling on the wall.

Now ask them to put the ball away from the source of light as in figure (b) and (c) and observe the size of the shadow.

Which shadow is bigger in size?

Which shadow is smaller in size?

(The shadow which is formed when the object is far from the source of light is smaller in size)



Size of the shadow decreases with the distance of the object from the source of light

Activity 3

Ask a student to repeat the previous activity 6.2.2 by fixing the ball. Let him/her hold the lighted candle/torch at different distances from it as shown in figure (a), (b) and (c) and observe the formation of shadow in these cases.

Ask them:

Which shadow is the darkest and biggest in size?

Which shadow is less dark and smaller in size?

Help them to infer that more light is obstructed when the source of light is near to the opaque object. Thus the shadow is more prominent, darker and bigger in size. When the source of light is away from the object, less light is obstructed so that the shadow is less prominent, less dark and smaller in size.

Note: Shadow formation also depends on the size and intensity of the source of light.

Ball, candle/ torch, match box

6. 3: How does the length of the shadow formed by the SUN change from morning to evening?

Focus on: Shadow, its length and direction

(2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Recognise the relation of the length and direction of the shadow formed by the SUN at different times on a day	Activity 1 Ask students to fix a wooden stick vertically in an open field or ground. Let them look at its shadow in the morning and make a mark where shadow falls. Let them note the length of the shadow and also the direction of the shadow with respect to the SUN. Is the shadow formed on the same side of the stick as the SUN?	Wooden stick, watch, scale/tailor's tape

Ask them to repeat the activity at different times on the day from morning to the evening and fill the results in the table.

Time	Length of the shadow	Direction of the shadow
8 am		
10 am		
12 noon		
2 pm		
4 pm		
6 pm		

Ask a student to repeat the activity by fixing a match stick with plasticine on the surface of the globe (as the EARTH) and holding it in the sunlight.
Let him/her rotate the globe gently and note down each time the length and direction of the shadow of the match stick formed by the SUN on the globe as it is rotated.

Match stick, plasticine EARTH-MOON model, tailor's tape

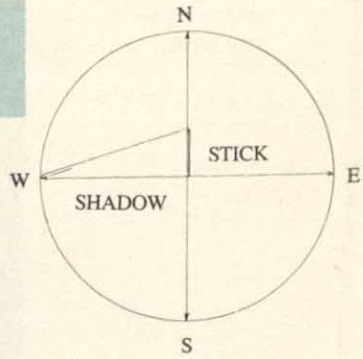
Compare their results and discuss.
Is there any change in the length of the shadow?
How is the shadow different at noon compared to morning or evening?
Why does the length of the shadow vary?
Help students to infer that the length of the shadow decreases from morning to noon and is shortest at noon. Then it increases from noon to evening. The direction of shadow formed is always opposite to the side of the source of light. Tell them that the length and direction of the shadow varies because of the rotation of the EARTH on its tilted axis.

E 1

Ask students to take a circular card board (about 30 cm diameter) and fix a wooden stick (about 10 cm in length) with plasticine at the centre of the cardboard

Card-board, wooden stick, plasticine, compass needle, watch, tailor's tape

vertically. Mark the direction N (North), S (South), E (East) and W (West) on its dial. Keep it in open place and observe the direction of the shadow of the stick on the dial hourly. Mark the shadow along with the time of its formation, on the dial.



Model of Sun dial

6. 4: How do eclipses occur?

Focus on: Distinction between a solar and a lunar eclipse

(4-5 Periods)

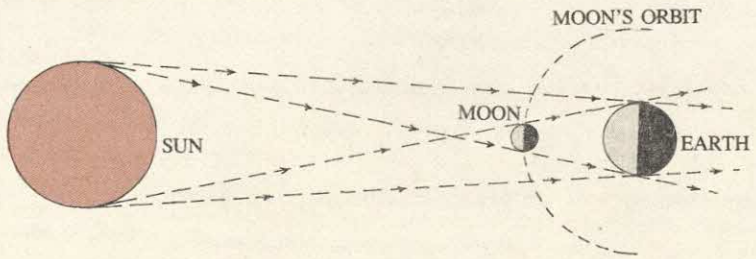
LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Relation between shadow formation and occurrence of eclipses	Activity 1 Ask students to arrange the EARTH-MOON model on the table in a room where there is not much light. Imagine that the globe/big ball represent the EARTH and the small ball depicts the MOON. Let them light the torch/candle which depicts the SUN. As a student to hold a lighted torch/candle (SUN) at some distance from the small ball (MOON). Let the students observe the shadow of the MOON on the surface of the EARTH as shown in the figure.	EARTH-MOON model, torch/candle

What do you observe?
(Shadow of the MOON on the surface of the EARTH)
What happens when the MOON's shadow falls on the EARTH?

(The portion of the EARTH which enters the MOON's shadow becomes dark)
Why does a portion of the EARTH become dark in this situation?
(The MOON obstructs the light coming from the SUN on the EARTH's surface)
What is the phenomenon of obstruction of light by a heavenly body called? (Eclipse)
Can a person who is in the MOON's shadow on the EARTH see part of the SUN which is covered by the MOON?
(No, the part of the SUN which is covered by the MOON cannot be seen in the MOON's shadow on the surface of the EARTH)

Recognise the occurrence of solar eclipse

What is the name for the phenomenon of obstruction of light, coming from the SUN, by the MOON?
(Eclipse of the SUN or solar eclipse)
How does a solar eclipse occur?
Help the students to realise when the SUN, the MOON and the EARTH are in a straight line, the shadow of the MOON falls on the EARTH as shown in figure.



Solar eclipse

The portion of the EARTH which enters in this shadow becomes dark and an eclipse of the SUN occurs.

Tell them that the solar eclipse occurs only on a new- moon day. When only a part of the SUN is covered by the MOON, we can see the SUN only partially, so it is called a partial solar eclipse.

Sometimes, the SUN appears to be completely covered by the MOON, it is called a total solar eclipse.

Note of warning:

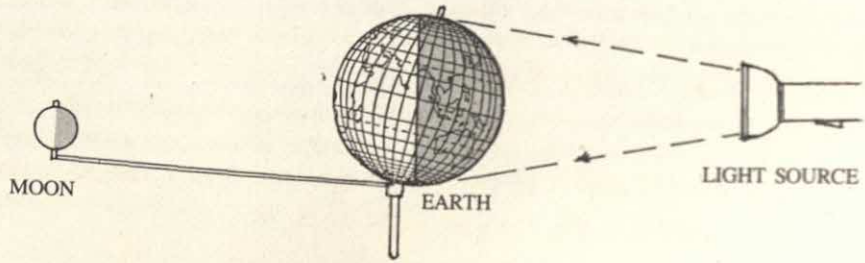
Warn the students not to see the solar eclipse directly with the naked eyes. It may damage their eyes.

Activity 2

Recognise the occurrence of lunar eclipse

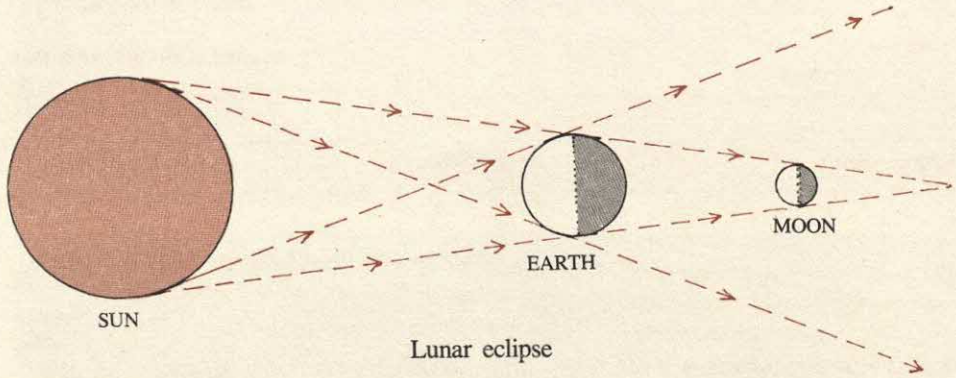
Ask a student to reverse the position of the big ball (globe) and the small ball (MOON) in the previous activity 6.4.1. Let the student move the small ball (MOON) around the globe (EARTH) and observe the entry of the MOON in the shadow of the EARTH as shown in the figure.

EARTH-MOON model, torch/candle



EARTH—MOON Model

What do you observe?
(Shadow of the EARTH falls on the MOON)
What happens when the shadow of the EARTH falls on the MOON?
(The portion of the MOON which enters the EARTH's shadow becomes dark and an eclipse of the MOON or lunar eclipse occurs)
How does the eclipse of the MOON occur?
Help the students to recognise when the SUN, the EARTH and the MOON are in a straight line, the shadow of the EARTH falls on the MOON as shown in the figure and an eclipse of the MOON occurs.



Lunar eclipse

Tell them that the lunar eclipse occurs only on a full-moon day. If only a part of the MOON is covered by the EARTH's shadow, we call it a partial lunar eclipse. As the MOON moves about the EARTH, it sometimes completely enters the EARTH's shadow and total lunar eclipse occurs.

What will happen when the SUN, the MOON and the EARTH are not in a straight line?

(No eclipse would occur in this situation)

Why does the solar eclipse not occur on a full-moon night?

Why does a solar eclipse not occur on every new-moon day?

Why does the lunar eclipse not occur on every full-moon night?

What is the necessary condition for eclipses to occur?

Help the students to realise that the relative positions of the SUN, the MOON and the EARTH are very important for eclipses to occur. Tell them that the path of the MOON round the EARTH and that of the EARTH round the SUN are not the same. If the full-moon day or the now-moon day falls on the day when MOON is at the point where the paths cross,then the SUN, the MOON and the EARTH are in a straight line, and eclipses occur.

Discriminate between solar and lunar eclipses

Ask the students to fill in the table below:

Characteristics	Solar eclipse	Lunar eclipse
Position of the MOON		
Position of the EARTH		
Day on which solar/		
lunar eclipse occurs		
Occurrence of eclipse on		
i) a new-moon day		
ii) a full-moon night		

E 1

Ask students to make models of lunar and solar eclipses on a board using yellow glazed paper for the SUN, green glazed paper for the EARTH and silver paper for the MOON. Yellow wool could be used for the SUN's rays.

Yellow, green, and silver paper, yellow wool

UNIT 7: NATURAL RESOURCES OF THE EARTH

Introduction

Students have been, in the previous classes, introduced to the natural resources of the EARTH in various lessons. They have also studied about the uses of these resources in different form.
In this Unit, the students will be able to

- identify and list down the various natural resources,
- understand the significance of interdependence in nature,
- identify the uses of natural resources,
- appreciate the need to conserve natural resources,
- identify renewable and non-renewable natural resources,
- identify causes of pollution and list ways in which pollution could be prevented.

7.1: What are the natural resources on the surface of EARTH and underground?

Focus on: Natural resources

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the natural resources	Activity 1 Ask the students to observe the surroundings in the class room and outside and to write the names of the things that are in use. Ask them: What is essential for our life? (Sunlight, air, water and food) From where do we get water and food? (We get water from wells, rivers, tube wells etc., and food from plants and animals) Make them understand that air, water, sunlight, plants and animals are in use from the very beginning and will be used in future also.	

List of some of the main natural resources with the place of their occurrence, is given below for your reference.

Name of the natural resource	Underground or on the surface of the EARTH
Plant	Surface
Animal	Surface
Water	Both underground and on the surface
Air	Surface
Sunlight	Surface
Coal	Underground
Petroleum	Underground
Minerals	Underground

Make them understand that materials provided by nature are called natural resources.
Help them to infer that the EARTH has many natural resources. Plants, animals, sunlight, water and air are natural resources on the surface of the EARTH.
Materials like coal, petroleum and minerals are available underground.

7.2: How do human beings use different natural resources?

Focus on: Use of different natural resources

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the ways in which air, water, plants and animals are used by human beings	Activity 1 Ask a student to take the water-wheel and move it by blowing air. Ask another student to take a deep breath.	Water-wheel

Ask them:

What is moving the water-wheel? (Moving air)

What do you breathe in? (Air)

Ask student A to fan another student B with a hand fan.

Ask student B:

How do you feel? (Cool)

Why? (Because of moving air)

Recall their previous knowledge about the process by which plants make food.

Make the students understand that air is used in:

— moving machines,

— breathing,

— cooling,

— the making of food by plants.

Activity 2

Recall the students' experience of using water in different ways. Ask them:

What are the different uses of water?

(Water is used for drinking, irrigation, cleaning, cooling, energy)

Recall the student's observations about the plants, animals and their products in everyday life.

Ask them:

What do we get from plants?

(Food, oxygen, fuel, wood, gum, wax, rubber, medicine, shelter, etc., and the plants also help us in preventing soil erosion and causing rains)

What do we get from animals? (Food, leather, medicines, wool, fuel-cow dung, bio-gas, oil/fat, work, etc)

Make the students understand that natural resources like air, water, sunlight, plants and animals and their products are very useful to human beings.

Identify the use of rocks, minerals, coal and petroleum

Rock

Iron ore

Activity 3

Show a small piece of rock to the students. Ask them:
What are the different ways in which we use rocks?
(Construction work, soil, extracting minerals, metals and chemicals)

Activity 4

Procure iron ore (haematite)/magnetite and show to the students. Ask them:

What is this? (This is a piece of rock)
Tell them that this is an ore/source of iron called haematite/magnetite.
Explain that an ore is a material dug out from the EARTH, and from which a metal can profitably be extracted.
From where do we get ores? (Rocks)
Generally we get ores by digging deep into the EARTH.
Sometimes the ores may be found on the surface of the EARTH as rocks, soil, etc.

Names of some ores and the metals obtained from them are given below for your reference.

Name of ore	Name of the metal obtained
Bauxite	Aluminium
Copper pyrites	Copper
Magnesite	Magnesium
Galena	Lead
Magnetite/haematite	Iron

Tell them that sometimes we put to use ores in the form they are found (e.g. rock salt). Sometimes we have to extract metals from the ores by removing impurities and then they are used.
Ask them:

How do we use minerals?
(Agriculture, medicines, food, metallurgy)

How do we use metals?
(Jewellery, utensils, pipes, etc.)
Make them understand that minerals are very useful to us.

Activity 5

Coal

Show a piece of hard coal to the students.
Ask them:
What is this? (Coal)
From where do we get coal?
(Coal is obtained from coal mines below the surface of the EARTH
What are the different uses of coal?
(Fuel, medicine)

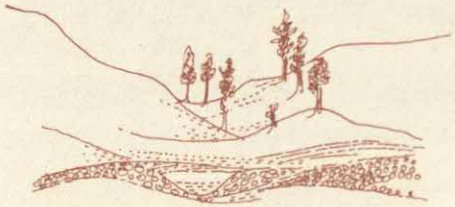
Activity 6

Recall the students' observation of using petrol, diesel, medicine, etc., in their everyday life. Tell them that substances like petrol and diesel are petroleum products.

Pertoleum is a dark, viscous liquid, dug out from the EARTH
What are the other petroleum products?
(Vaseline, benzene, coal-tar, cooking gas, gasoline)

How do we use these products?

Make them understand that rocks, minerals, petroleum and coal are important underground natural resources which are widely used by human beings.



7. 3: What is the need of conservation of natural resources?

Focus on: Conservation of natural resources

(1 Period)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS
Identify the need for conserving natural resources	Activity 1 Recall the student's observation of water tap being left open on the roadside continuously. Ask them: What will happen if taps are left open? (Sooner or later, the supply of water will be exhausted) Tell the students that water for the taps is supplied through a storage tank in which there is a limited quantity of water. If water is used continuously, it will soon be exhausted. What will happen when water is used up and exhausted? (Water will not be available and we will be deprived of water for drinking and other useful purposes) Make them understand that similarly the supply of natural resources is limited. Therefore, the natural resources should be used judiciously and there is a need to save them.	

7.4: What are the steps for conservation of natural resources?

Focus on: Conservation of natural resources

(1-2 Periods)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Identify various steps for conservation of natural resources

Activity 1

Recall the students' observation of wastage of natural resources in their everyday life.
Help them to fill in the table which is partially filled for your reference.

Name of natural resource	Ways of wastage/ pollution	Ways of conservation/ checking pollution
Air	Formation of smoke, dust	Minimising formation of smoke and dust
Water	Leaving taps open, lack of proper garbage disposal, lack of sewage	Closing taps properly after use, proper disposal of garbage, proper sewage
Plants	Indiscriminate cutting and uprooting	Not cutting and uprooting plants indiscriminately
Animals	Killing for food and hides	By not killing animals
Rocks		
Minerals		
Petroleum		
Coal		
Sunlight		

7.5: What are renewable and non-renewable resources?
Focus on: Renewable resources and pollution in nature

(1 Period)

LEARNING OUTCOMES	SUGGESTED TEACHING STEPS	MEDIA & MATERIALS

Understand the meaning of the word renewable and non-renewable and identify the resources which are renewable

Activity 1

Recall the students' experiences with reference to water cycle in activity 4.3.3 of class III.

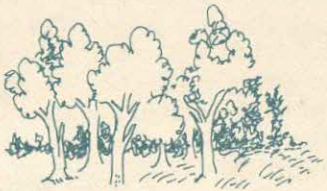
Ask:

What happens to the water when it boils?
Why does steam condense on the funnel?

Help them to infer that water is a renewable resource. It vaporises from the water bodies, moves up higher and higher, then condenses and falls to the EARTH again as rain. Renewable resources are available continuously or can be renewed at short intervals of time.
The supply of non-renewable source of energy is limited and it takes very long time to renew their supply.

Ask them:

Which are the other renewable resources?
Which are the non-renewable resources?



Ask them to fill in the table. (The table is filled in for your reference)

Renewable resource	Non-renewable resource
Air	
Water	Petroleum
Forest	Metallic ore
Animal wastes	Soil
Sunlight (solar energy)	Coal

Recognise that air and water should not be polluted, since they are renewable resorces

Recall the activity 7.4.1 for the ways of conservation and checking pollution of air and water. Tell students that air and water should not be polluted since they are essential for our life. Make them understand that air and water are renewable by either some activities of the human beings or by nature itself, whereas it is very difficult to renew other resources.

Annexure I

Participants of the workshops held at Delhi during 1987-88 at various stages in the development, review, refinement and finalisation of the manuscript of the Teacher's Handbook on Environmental Studies—Science for Class V

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GANDHIJI'S TALISMAN

"I will give you a talisman. Whenever you are in doubt or when the self becomes too much with you, apply the following test :

Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it ? Will it restore him to a control over his own life and destiny ? In other words, will it lead to Swaraj for the hungry and spiritually starving millions ?

Then you will find your doubts and your self melting away."

M K Gandhi

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